September 24, 1956 50 Cents

# AVIATION WEEK

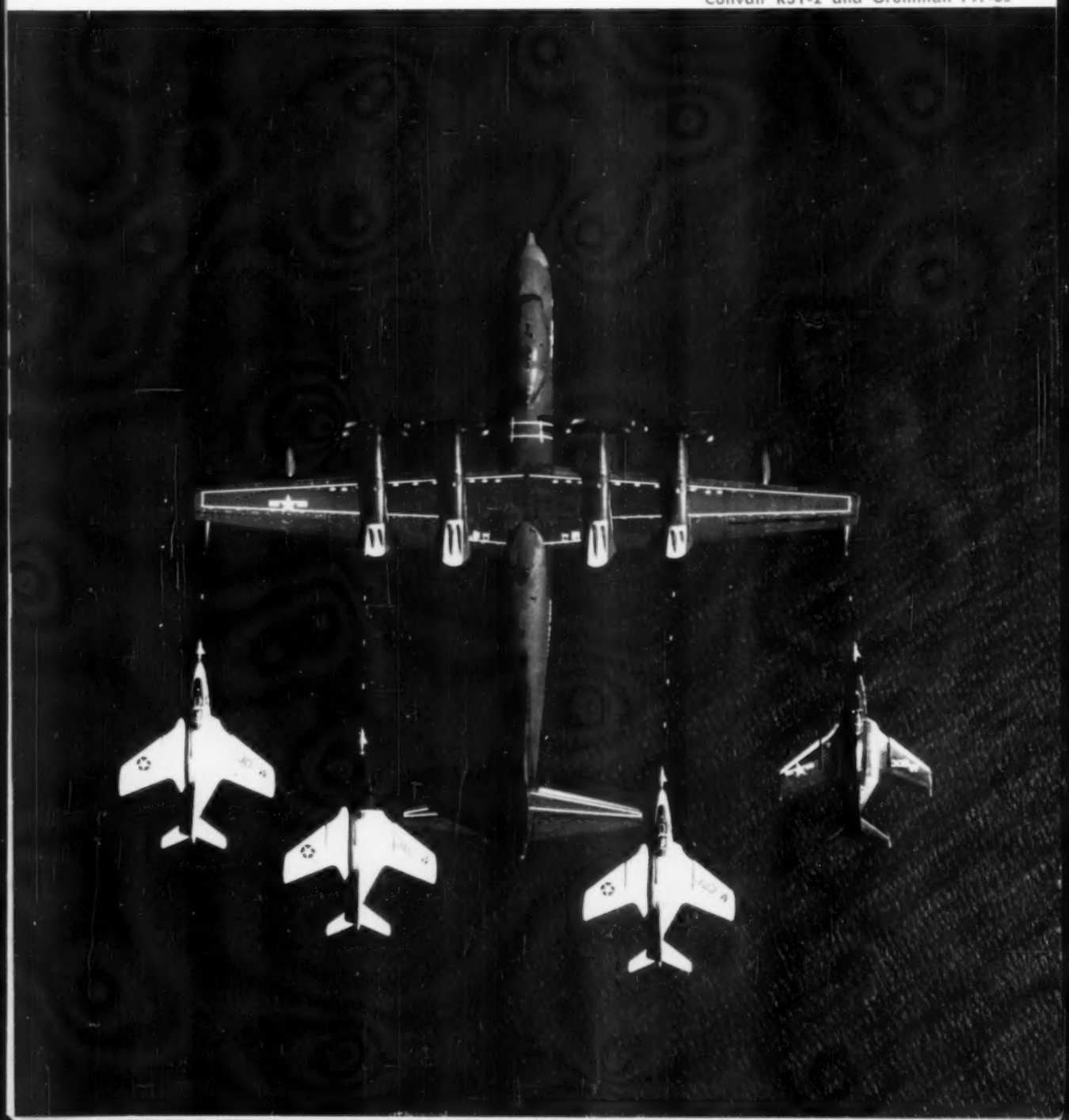
A McGRAW-HILL PUBLICATION

## Vortac Impact on Avionics Industry

•

## Report on Space Scientists in Rome

Convair R3Y-2 and Grumman F9F-8s



CONVAIR 880
JET-LINER

# Picture of your bright "jet-travel" future!

**Fastest commercial airplane in the world** – 609 silent, vibrationless miles an hour! The Convair 880 JET-LINER will be powered by four of the world's most advanced commercial jet engines–General Electric CJ-805's. **The only jet transport designed to operate from over 100 already existing airports throughout America!** Big city or small, the Convair 880 JET-LINER will bring you luxurious jet-travel whether your destination is 2,000 miles away – or only 300. Soon you will travel faster, in more luxury and comfort than you've ever known before in Convair's 880 – the all-new JET-LINER.

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION

CONVAIR 880 JET-LINER WILL FLY FIRST OVER THE ROUTES OF
TWA AND Delta

# The C-123 can't stop on a dime—

## *but it can land in 700 feet!*

**FAIRCHILD**

**AIRCRAFT DIVISION • HAGERSTOWN 10, MARYLAND**

*A Division of Fairchild Engine and Airplane Corporation*

**...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!**

Meet the most agile, the most sure-footed transport in the world – the Fairchild C-123. It is capable of air-lifting up to 60 troops, or up to eight tons of bulk combat cargo – and it needs no mile-long concrete runway.

Almost any clearing, almost any field is a potential C-123 airbase; even deeply rutted, ungraded, or sandy grounds are taken in stride by this rugged ship. And sophisticated aerodynamic design makes possible a landing run of only 700 feet – a takeoff run only a little longer.

Performance, ruggedness, payload and versatility . . . these are traditional hallmarks of Fairchild aircraft.

SUBMINIATURE TRIMMING POTENTIOMETERS FOR THE

**HOT SPOTS**

IN YOUR ASSEMBLIES

**BOURNS** *Model 160*

**TRIMPOT**®

*—new high temperature, high power design*

This instrument operates reliably in high ambient temperatures, or wherever closely massed components generate localized hot spots. The TRIMPOT will withstand temperatures up to 175° C. (347° F.) with unimpaired efficiency. Lead wires are Teflon insulated. High power dissipation— 0.6 watt at 50° C. (122° F.)

You'll find every outstanding feature of the original Model 120 TRIMPOT—standard of the industry—built into the Model 160. 25-turn adjustments are made with a screwdriver on the slotted shaft. The shaft is self-locking, to provide stable settings. Resistance element is precision wound with low temperature-coefficient resistance wire. Unit withstands severe shock, vibration and acceleration. To assure its dependable performance under extreme environmental conditions, Bourns designed the Model 160 TRIMPOT to meet or exceed rigid government specifications.

*Write for new descriptive literature.*

BOURNS LABORATORIES

General Offices: 6135 Magnolia Avenue Riverside, California
Plants: Riverside, California—Ames, Iowa

COPR. BL.


## AVIATION CALENDAR

**Sept. 24-26**—American Rocket Society, fall meeting, Hotel Statler, Buffalo, N. Y.

**Sept. 24-28**—1956 Trade Fair of the Atomic Industry, Navy Pier, Chicago, Ill.

**Sept. 26**—National Security Industrial Assn., Waldorf-Astoria, New York City.

**Sept. 27-28**—Fourth Michigan Aeronautics Conference, sponsored by Michigan Association of Airport Managers, Manistee, Mich.

**Sept. 27-29**—Southern California's Engineering Conference & Exhibit, sponsored by Engineers and Architects Assn., San Diego Chapter, Balboa Park, San Diego, Calif.

**Sept. 29**—New England Regional Helicopter Air Display of American Helicopter Society, Municipal Airport, Danbury, Conn.

**Oct. 1-3**—12th Annual National Electronics Conference, sponsored by American Institute of Electrical Engineers, Institute of Radio Engineers, Illinois Institute of Technology and Illinois and Northwestern Universities, Hotel Sherman, Chicago, Ill.

**Oct. 2**—1956 Aircraft Spark Plug and Ignition Conference, Secor Hotel, Toledo, Ohio.

**Oct. 2-6**—Society of Automotive Engineers, National Aeronautic Meeting, Aircraft Production Forum and Engineering Display, Hotel Statler, Los Angeles, Calif.

**Oct. 3-5**—1956 National Airports Conference, Univ. of Oklahoma, Norman, Okla.

**Oct. 4-6**—Biennial Technical Conference, University of Minnesota, Rosemount Aeronautical Labs., Rosemount, Minn.

**Oct. 8-9**—Aeronautical Communications Symposium, Hotel Utica, Utica, N. Y.

**Oct. 8-10**—Third jointly sponsored annual Lubrication Conference of American Society of Mechanical Engineers-American Society of Lubrication Engineers, Chalfonte-Haddon Hall, Atlantic City, N. J.

**Oct. 10-12**—Society of Automotive Engineers, National Transportation Meeting, Hotel New Yorker, New York.

**Oct. 10-12-16**—National Advisory Committee for Aeronautics' triennial inspection of Langley Aeronautical Laboratory.

**Oct. 25-26**—Aircraft Electrical Society Annual Equipment Display, Pan Pacific Auditorium, Los Angeles, Calif.


**AVIATION WEEK • SEPTEMBER 24, 1956**

**Vol. 65, No. 13**

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph T. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

**Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.**

**Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.**

Single Copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A.


Copyright 1956 by McGraw-Hill Publishing Co. Inc. All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

Phillips 66
PRESENTS
MILESTONES IN AVIATION

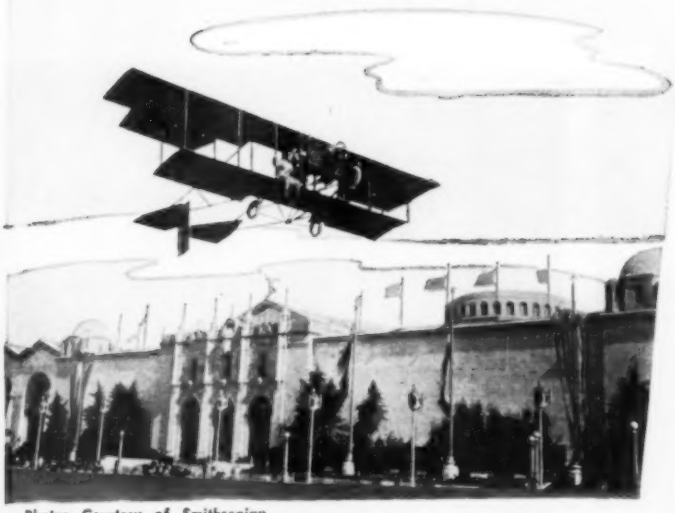
# Bird Boy Art Smith

Whenever daring exploits of pioneer aviators are chronicled, the name of Bird Boy Art Smith is sure to appear. From the time he flew his first Curtiss-type biplane in 1911 until his death in 1926, Art Smith dedicated his life to aviation.

The romance of his life was heightened by the unselfish encouragement of his mother and father, who mortgaged their home so that their son could have the money to build his first airplane. Another inspiration of his early years was his sweetheart, Aimee Cour. They eloped in 1912 in what is considered to be the world's first airplane elopement.

Flying in such places as Deadwood, S. Dakota, and in the capital of Japan, Art Smith set the world record for looping the loop, pioneered sky writing and invented dozens of breath-taking stunts to win acclaim of millions throughout the world.

The custom of showing admiration for Art Smith's flying by giving him a medal started with a flight he made in the Black Hills in 1912. One of his most prized awards was a gold nugget, given him by his hero, Buffalo Bill.



*Photos Courtesy of Smithsonian Institution, National Air Museum*

Phillips 66
AVIATION PRODUCTS

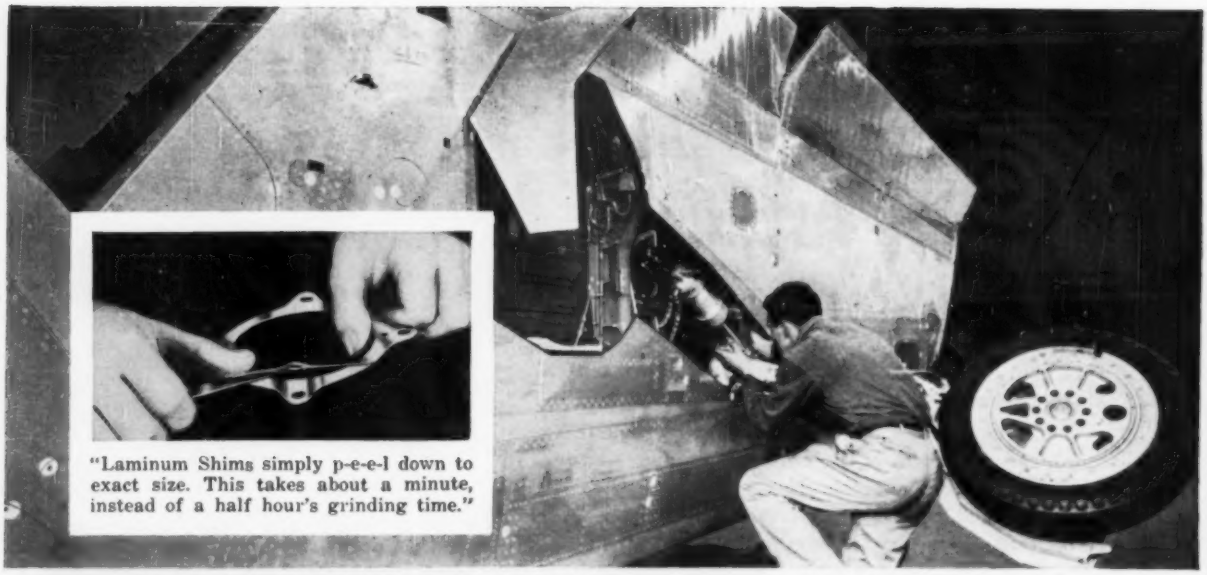
***It's Performance that Counts!***

A pioneer in research and manufacturing to meet aviation needs, Phillips Petroleum Company continues its leadership as a supplier of high octane gasoline and new *super performance* Jet Fuels for today's aircraft.

Since aviation's early days, Phillips has taken an active part in setting up higher standards for aviation fuel. In fact, Phillips pioneered in producing such important Avgas components as HF Alkylate and Di-isopropyl.

In aircraft fuels, it's performance that counts. And military and commercial operators know they get *super* performance from Phillips *66* products.

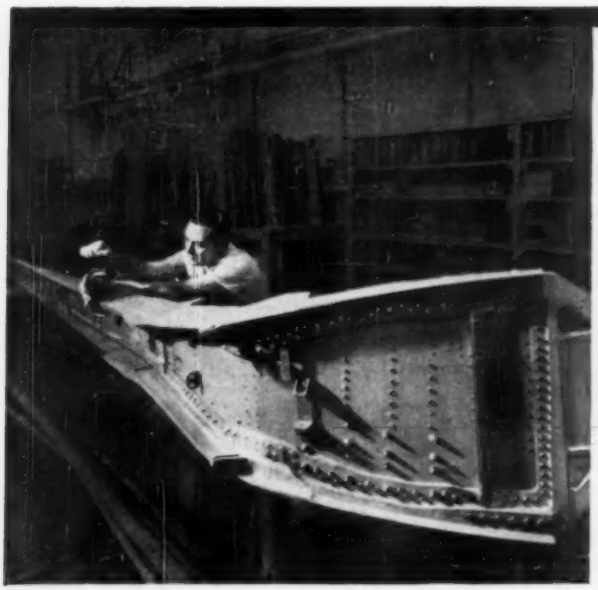
AVIATION DIVISION
PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA



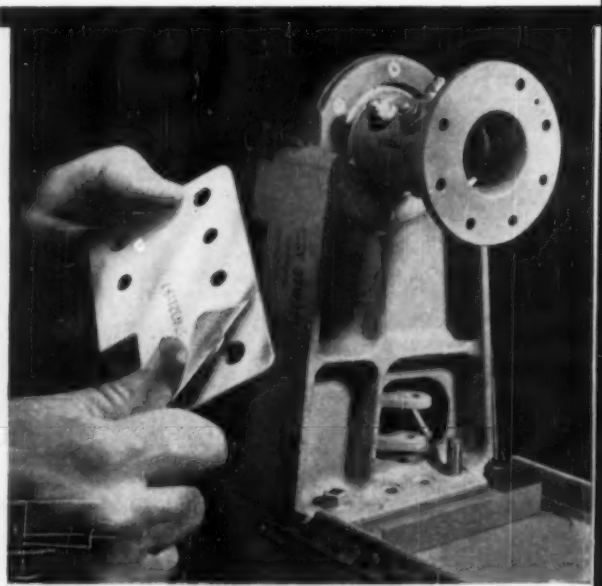
"Laminum Shims simply p-e-e-l down to exact size. This takes about a minute, instead of a half hour's grinding time."

"We use Laminum to provide precise spacing between the trunnion and the landing gear cut-outs on the strut."

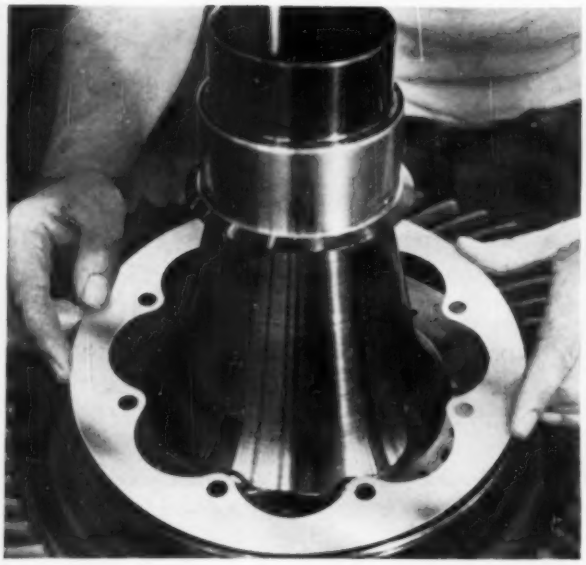
# Aircraft Producers advise..."as tolerances b



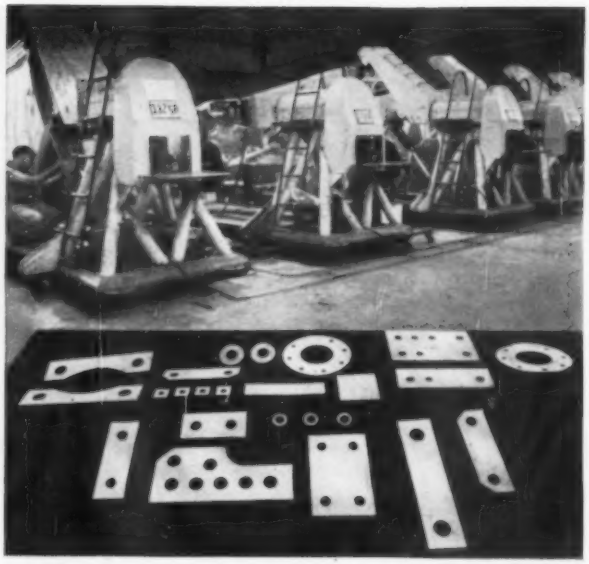
"We join this leading edge wing spar in 6 places, and the Laminum Shim at each place assures maintaining the BCL of the wing."



"For the trailing edge wing spar, we peel Laminum Shims down to an exact fit between the center line of the spar and the center line of the horn."



"This 10" Laminum Shim is pared to exactly .065" in thickness, and we do it in a matter of minutes."



"Here are just a few of the many types of Laminum Shims used on our main jig line for wing assemblies."

# become tighter, Laminum® is a must!"

**LAMINATED SHIMS OF**

**LAMINUM®**

SURFACE BONDED... THEY *peel* FOR ADJUSTMENT

The demand for Laminum Shims has grown so much during the past few months that we wondered just exactly why, where and how they are being used so extensively. We put the question to assembly specialists in major aircraft plants, and here are their answers—not what we say, but what *they* say about the use of Laminum Shims in modern aircraft production...

**"Our BCL (basic contour line) is maintained to precise specifications with Laminum Shims. Without them, the wing components would tend to twist with the forces of modern jet flight."**

***"Shims must lie flat for a close fit, which we always get with Laminum Shims. As tolerances become tighter, Laminum is a must to maintain production schedules."***

**"In the past we would either have to wait for an available lathe, or grind or hand-file a shim to fit. With Laminum, we do a precision job in minutes."**

***"Laminum Shim units cost about the same as solid shims. But they eliminate material losses. Reduce inventory and handling. Streamline production."***

are custom-made precisely to blueprint. Laminations are completely surface-bonded to look and act like solid metal, yet quickly p-e-e-l to a precision fit right at assembly. Available in Brass, low carbon Steel and Type 302 Stainless, with .002" or .003" laminations. Also in Aluminum with .003" laminations. Laminum Shims eliminate costly extra operations: no machining ... no grinding ... no stacking ... no miking. And no grit between layers — ever!

**FREE!** Actual sample of LAMINUM—also illustrated *Engineering Data File.* Write for your copy today.

LAMINATED SHIM COMPANY, INC.

5109 UNION STREET, GLENBROOK, CONNECTICUT

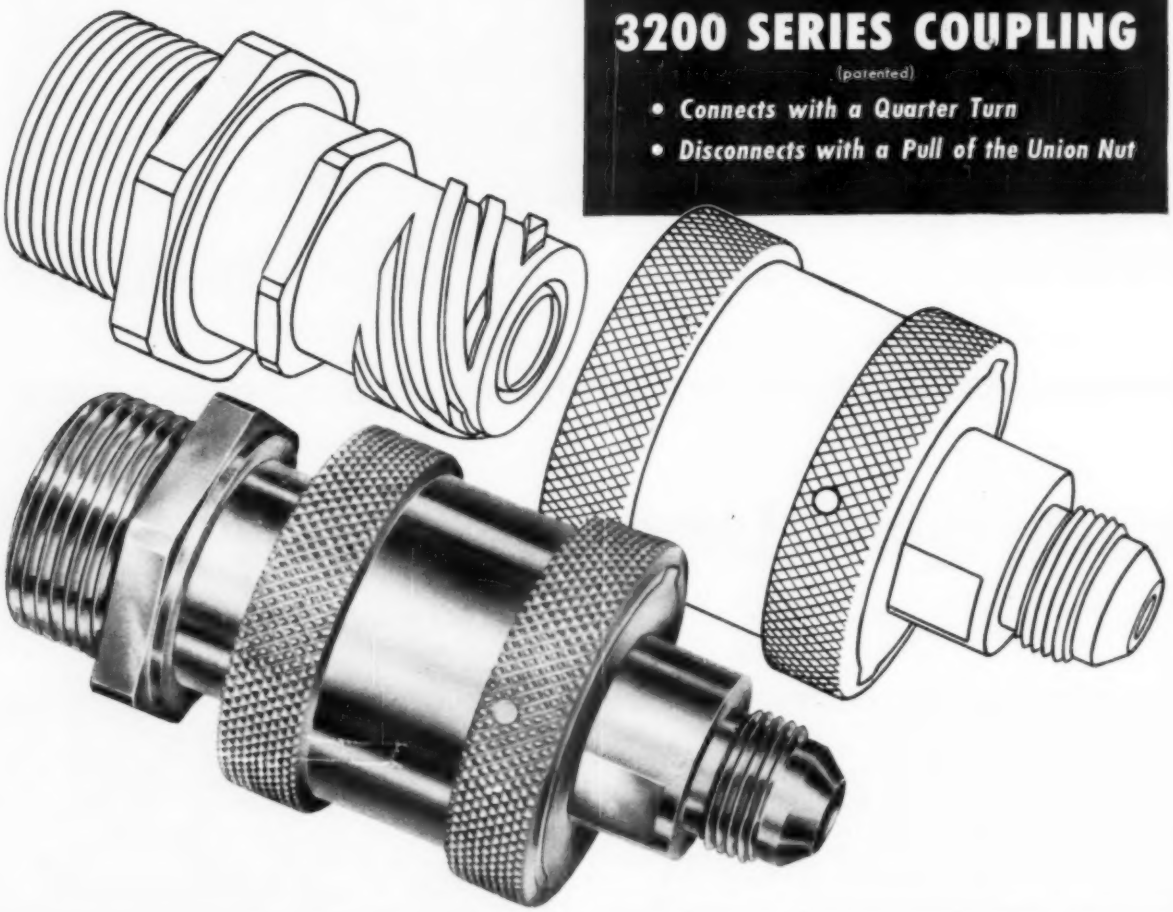
**SHIM HEADQUARTERS SINCE 1913**

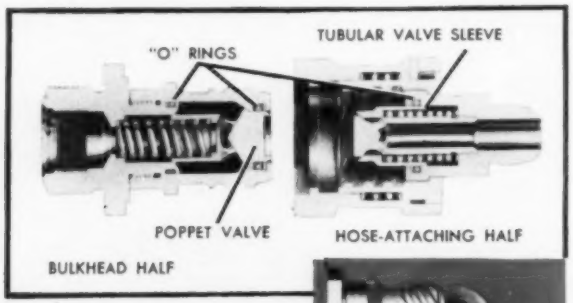
# Aeroquip Announces a NEW

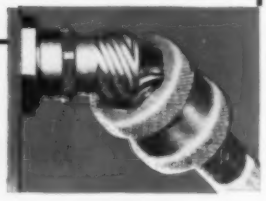
## 3200 SERIES COUPLING

(patented)

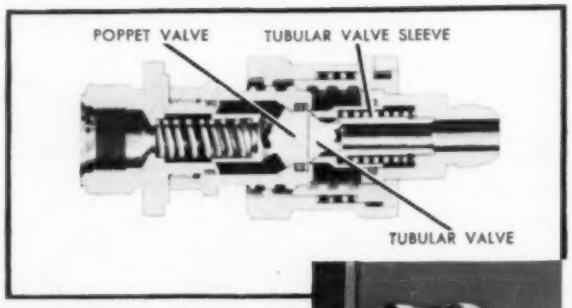
- *Connects with a Quarter Turn*
- *Disconnects with a Pull of the Union Nut*

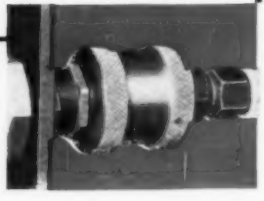




**DISCONNECTED COUPLINGS with valves closed.** The cutaway view, above, shows how the internal "O" rings provide unexposed and fully protected seal for poppet valve and tubular valve sleeve. All coupling parts are precision made from carefully selected materials.



**HALVES ALIGNED,** union nut not engaged, both valves still closed. Note how the poppet in the bulkhead half aligns and mates with the sleeve and the tubular valve in the hose-attaching half to prevent air from entering system.

# 3000 PSI. Self-Sealing Coupling

**SAFE**... may be checked visually or manually for locked position.

**SIMPLE**... there are only 13 parts plus "O" rings and back-up rings.

**FOOLPROOF**... there is no stable intermediate position where the coupling is partially open and unlocked.

**NO FLUID LOSS**... the patented Aeroquip design prevents fluid loss during connection and disconnection.

**NO AIR INCLUSION**... the coupling cannot admit air into the fluid system during connection and disconnection.

## Designed to meet the requirements of proposed military specification MIL-C-25427

It took *Aeroquip* to improve on Aeroquip Self-Sealing Couplings!

The new 3200 Series Self-Sealing Coupling offers the same basic advantages for which Aeroquip Couplings are well known: NO fluid loss upon disconnection; NO air inclusion during connection. In addition, it offers plus advantages that contribute to improved design, maintenance, and service of aircraft.

*It's fast acting!* A quick quarter-turn of the union nut fully connects the halves and assures full flow of fluid. An axial pull on the union nut disconnects the coupling causing the halves to spring apart instantly with valves closed.

*It features visual and manual check for locked position!* By noting the position of the locking hex, or attempting to turn the union nut, or by tugging on the attached hose line, anyone can tell whether the coupling is fully connected. Once connected, the coupling cannot unlock accidentally during normal service.

*It features simplicity of design . . . precision construction!* Developed especially for use on modern airframe and engine hydraulic systems up to 3000 psi. at 275°F., the 3200 Series Self-Sealing Coupling is highly recommended for use wherever lines must be disconnected while systems are operational.

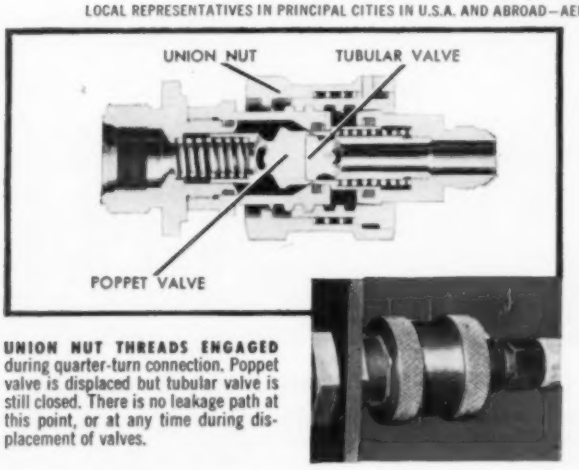
For further information, write for Engineering Bulletin AEB14.

Aeroquip

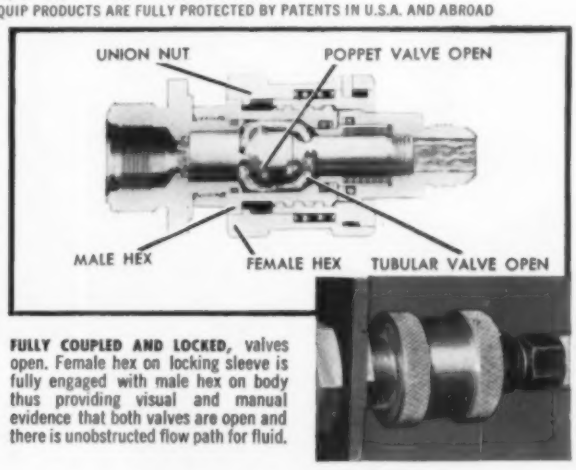
REG. TRADEMARK

**AEROQUIP CORPORATION, JACKSON, MICHIGAN**
**AERO-COUPLING CORPORATION, BURBANK, CALIFORNIA**
***(A Subsidiary of Aeroquip Corporation)***

IN CANADA: AEROQUIP (CANADA) LTD., TORONTO 15, ONTARIO
LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD—AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD




**UNION NUT THREADS ENGAGED** during quarter-turn connection. Poppet valve is displaced but tubular valve is still closed. There is no leakage path at this point, or at any time during displacement of valves.




**FULLY COUPLED AND LOCKED,** valves open. Female hex on locking sleeve is fully engaged with male hex on body thus providing visual and manual evidence that both valves are open and there is unobstructed flow path for fluid.

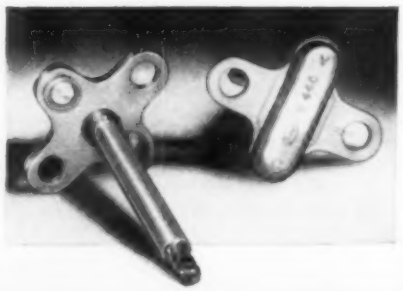
# Announcing...

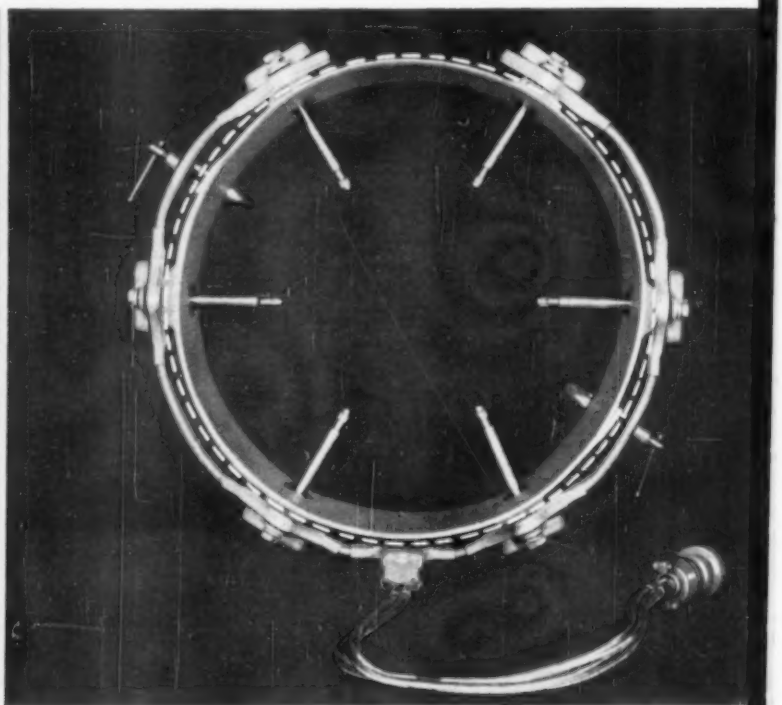
## FENWAL'S NEW JET ENGINE HARNESS AND INTERCHANGEABLE THERMOCOUPLES, PROVIDING

- **Operation at temperatures over 1200°F**
- **Foolproof installation, simplest maintenance**

### A NEW CONCEPT IN TERMINALIZATION

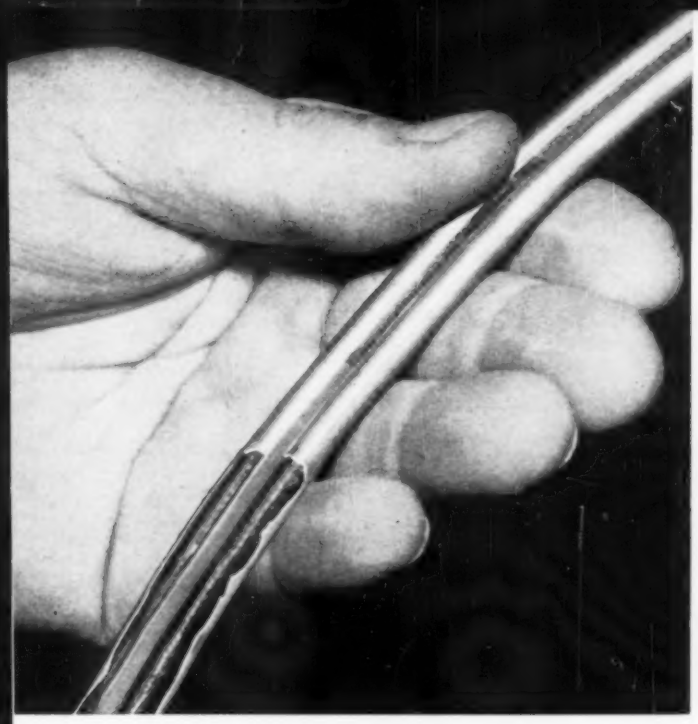
Fenwal's new concept of Button Terminalization for integrated assembly of thermocouples and harness allows a new ease of installation. Only two bolts — and buttons make firm, reliable electrical contact! It can actually be installed in 15 minutes by a mechanic who has never seen it before. All the thermocouples are offset — and can only be installed in one way. And should a thermocouple go bad all you have to do is remove two bolts and insert another thermocouple. And that's a great advantage in maintenance.

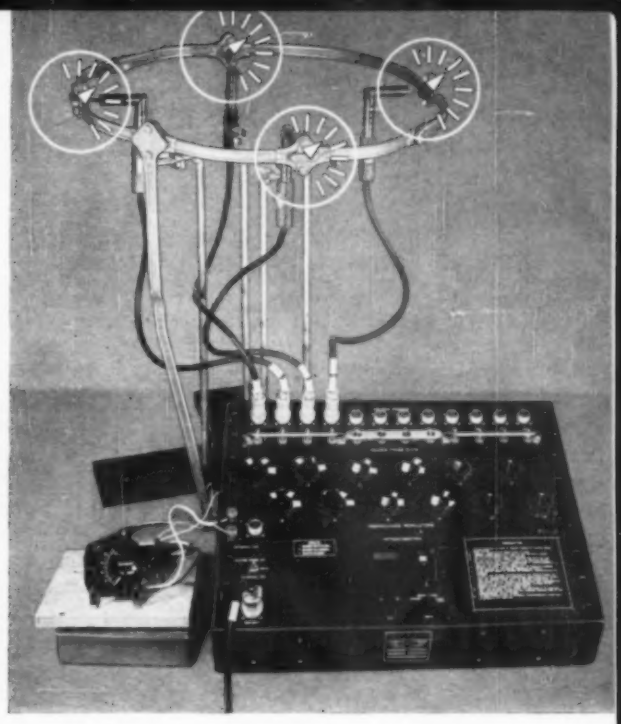




### DIFFERENTIAL EXPANSION NO PROBLEM

Fenwal's new Button Terminalized harness is rigid, yet flexible enough so that differential expansion will not cause difficulties. It is so designed that even when bolted in place the harness is flexible enough so that no great stresses are placed upon the thermocouple bosses or mounting bosses for the harness. That means holding brackets do not have to be "beefed up" in order to withstand large forces due to differential expansion.



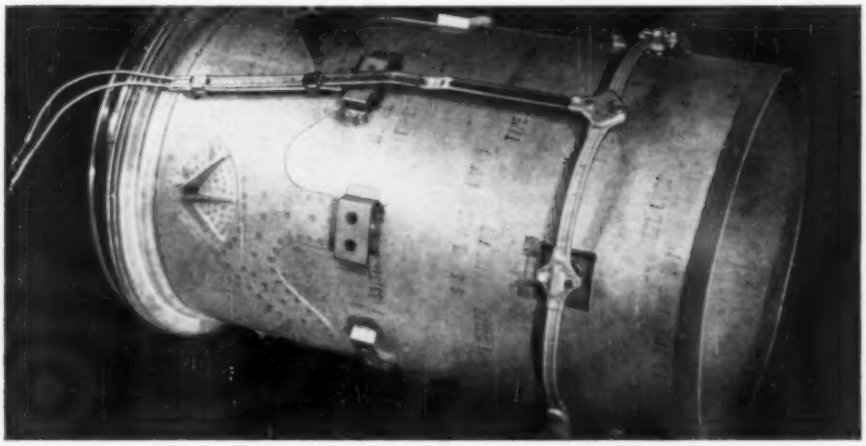


**SOLID STAINLESS STEEL CASING PROTECTS WIRES**

Even the wires on the Fenwal harness are encased in an insulated blanket and inserted in a stainless steel covering. This prevents the wire from becoming frayed and unraveled during installation or from vibration while in use.

**BALANCED RESISTANCE HARNESS**

The resistance path from each thermocouple to the indicator is equal, minimizing undesired circulating currents and enabling maximum accuracy.



**ENGINE TEMPERATURE INDICATION AND/OR CONTROL**

**WRITE FOR ALL THE FACTS**

Fenwal's new concept of integrated harness and thermocouples may be of great service to you. Write for complete data now, to **Fenwal Inc., Aviation Products Division, 129 Pleasant Street, Ashland, Mass.**

Fenwal's new Button Terminalized thermocouple and harness assembly is ideal for indicating temperature. It is also used for control because of the great reliability of the Fenwal thermocouple. In fact, Fenwal thermocouples and harnesses can be used on any size gas turbine aircraft engine. They will withstand ambient temperatures over 1200°F.

**Fenwal**

**Controls Temperature ... *Precisely***

# How Holley's Compressor Governors Help New Jets to Supersonic Speeds

"City-savers" Air Force men call them: the J-57-powered F-100, F-101, F-102 and Navy F8U, with level flight speeds faster than sound. And city-savers they could well be. Certainly their rapid approach to the fringe of Mach 2 heralds a new era in the progress of jet flight.

Sharing in the development of this new brood of supersonic fighters, Holley engineers, working closely with Pratt & Whitney Aircraft on the J-57 engine, designed the compressor bleed governor.

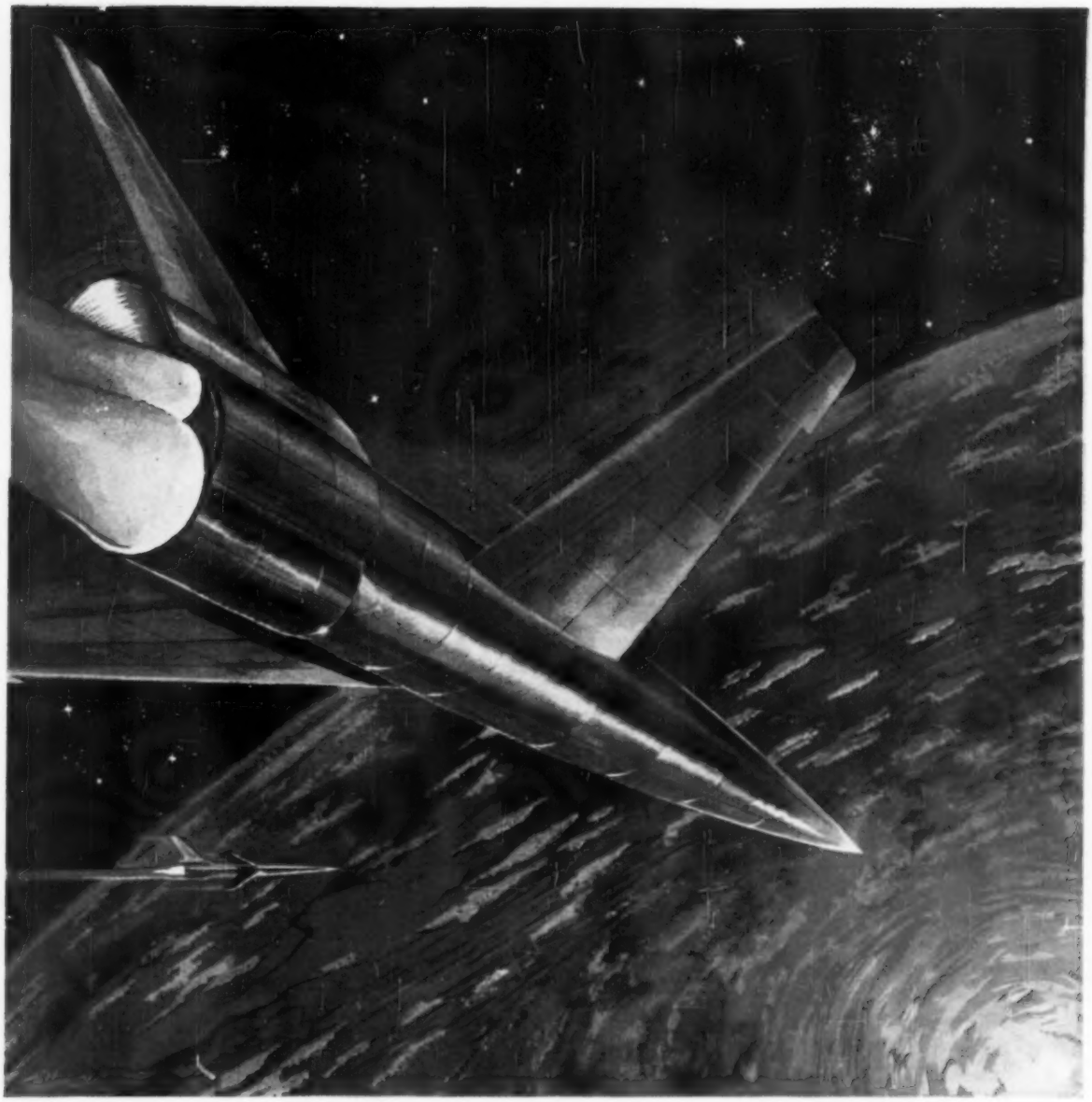
This new Holley compressor bleed governor is one more example of Holley's continuing leadership in the design, development and manufacture of superior engine control systems for both military and civilian use

*Leader in the design, development, and manufacture of aviation fuel metering devices.*

HOLLEY Carburetor Co.

11955 E. Nine Mile Road — Van Dyke, Michigan

A-24



# When the heat's on...

*Do your specifications call for operations in extreme temperatures* with precision accuracy and unfailing dependability in gear control systems, actuators, accessory drives or miniaturized rotary electrical equipment? If so, Western Gear designing, manufacturing and research skills can quickly step in to solve your most difficult problems with on-time deliveries. Forty years of aircraft industry experience assures satisfaction. Consult us now!

*"The difference is reliability" • Since 1888*

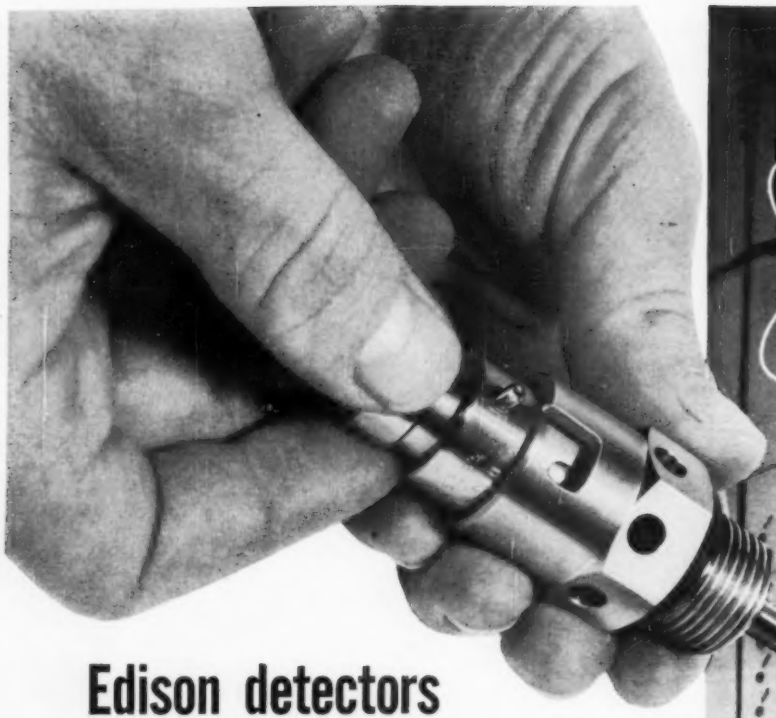
5623

*Address General Offices P. O. Box 182, Lynwood, Calif.*

PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE AND HOUSTON... REPRESENTATIVES IN PRINCIPAL CITIES

WESTERN GEAR Corporation

ENGINEERS AND MANUFACTURERS



# Edison detectors give speedy warning of overheat in atomic pile

***Self-monitor design assures fail safe operation***

New Edison Resistance Temperature Detectors are especially developed to meet the exacting demands of the atomic power industry. These detectors are now helping forestall costly fuel cell damage by providing near-instantaneous detection of a rise in temperature in light water moderators.

Super reliable and simple in design, Edison detectors eliminate complex electronic components. Some are rated at 0.8 seconds maximum response time and the high temperature types give an accuracy of ±1.0% at 750°C. Radiation- and corrosion-resistant, Edison detectors have quick disconnect features for reduction of installation and maintenance time.

Write for Bulletins 3016 and 3036 for information on types of Resistance Temperature Detectors and remote temperature monitoring systems for every purpose.

Thomas A Edison

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

**Thomas A. Edison**

INCORPORATED

INSTRUMENT DIVISION • 49 LAKESIDE AVENUE • WEST ORANGE, NEW JERSEY

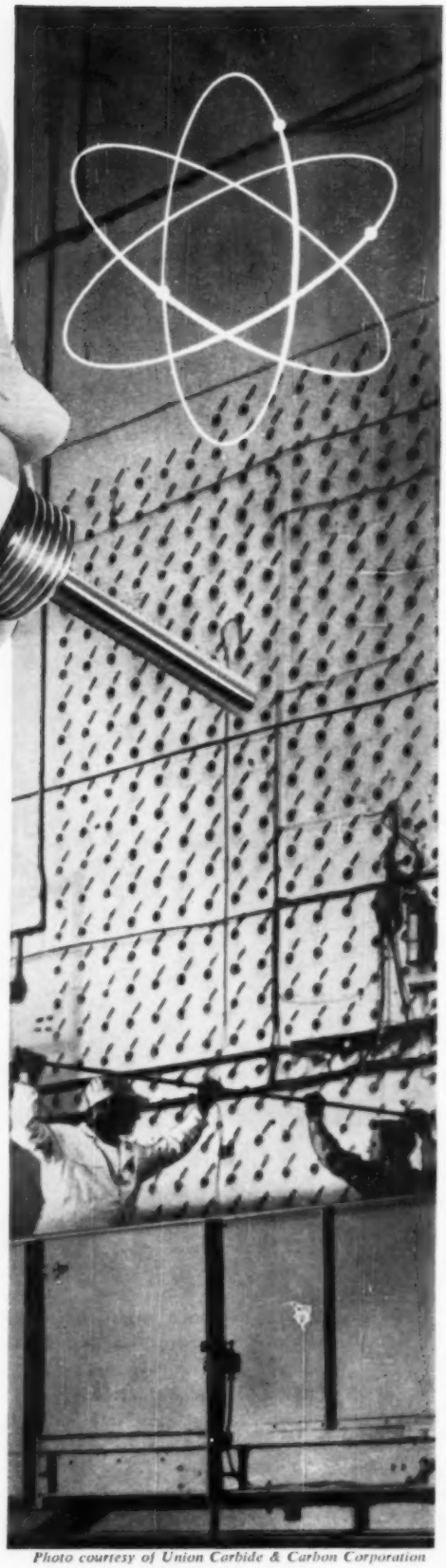


*Photo courtesy of Union Carbide & Carbon Corporation*

## Meet the New ELECTRO-SNAP "LANDING GEAR SWITCH"

**ELECTRO-SNAP H1-43**

with Rugged, **ADJUSTABLE** Roller-Arm Actuator!

Now you can get stepless actuator-arm adjustment in a tougher, lighter version of ELECTRO-SNAP's reliable H1-8, "The Landing Gear Switch". The new H1-43 is *interchangeable with the H1-8*, and is easy to install and adjust to the desired operating point . . . just turn the socket screw with the landing gear in the proper position. When the switch trips, set the lock nut.

Electrically and mechanically, the new H1-43 has the same proven operating life as the H1-8; *a minimum 200,000 electrical or mechanical cycles!* And the new case keeps the switch hermetically sealed throughout its long life . . . despite heat, cold, shocks, and knocks by flying gravel and stones.

Nearly simultaneous make-and-break operation of the double-pole switching element and the D.P.D.T., D.P.N.C., D.P.N.O. or 4-circuit D.P.D.T. contact arrangements give circuit designers the latitude they need in simplifying complex circuits.

**Get full details:**
**WRITE FOR DATA SHEET NO. H1M-9**

ELECTRO SNAP

**ELECTRO-SNAP SWITCH & MFG. CO.**
4232 West Lake Street • Chicago 24, Illinois

## Meet the New ELECTRO-SNAP "LANDING GEAR SWITCH"

**ELECTRO-SNAP H1-43**

with a . . .
**LIGHTER, TOUGHER HERMETICALLY-SEALED RIBBED CASE!**

**PROTECTION** is the key word. Switches for fast-flying, hot-landing aircraft need plenty of protection . . . and the H1-43 "Landing Gear Switch" exceeds requirements! *Three* "beefed-up" mounting lugs hold the switch rigidly and can take over-torquing without damage. Dry, inert gas is sealed inside . . . *permitting full electrical rating at any altitude!* And the entire case is made more rigid by ribs backing the closure plate.

**PROTECTIVE** enamel coating over zinc chromate stops corrosion before it starts, and the actuator assembly is made of corrosion-resistant steel. Easy-to-read metal decals identify the switch and the contact arrangement at a glance . . . more protection against mistakes and wasted time during check-out and maintenance.

**Get full details:**
**WRITE FOR DATA SHEET NO. H1M-9**

ELECTRO SNAP

**ELECTRO-SNAP SWITCH & MFG. CO.**
4232 WEST LAKE STREET
CHICAGO 24, ILLINOIS

## Meet the New ELECTRO-SNAP "LANDING GEAR SWITCH"

**ELECTRO-SNAP H1-43**

with these **SPECIFICATIONS**

| | |
|---|---|
| Leak Rate | Less than 1 Micron/cu. ft./hr. |
| Actuator Arm Adjustment | 14°±2° |
| Electrical Rating | |
| 125/250 V a-c | 15 Amps |
| 30 V d-c (Resistive) | 15 Amps |
| (Inductive) | 10 Amps |
| With Adjustment Fully Closed | |
| Pretravel | 0.100±0.031" |
| Movement Differential | 0.062±0.025 —0.000" |
| Overtravel | 0.281" Min. |
| Min. Mechanical Cycles | 200,000 |
| Min. Electrical Cycles | 200,000 |
| Operating Force | 4 LB+2 —0 |
| Overtravel Force | 11 LB±3 |
| Difference in Operating and Reset Point Between Each Pole | 0.010" Max. |
| Ambient Temperature Range (Std.) | —100F to +250F |
| Higher Temp Models Available | |
| Weight | 8 Ozs. Max. |

**CONTACT ARRANGEMENTS**

Double-Pole Double-Throw 4 Circuit

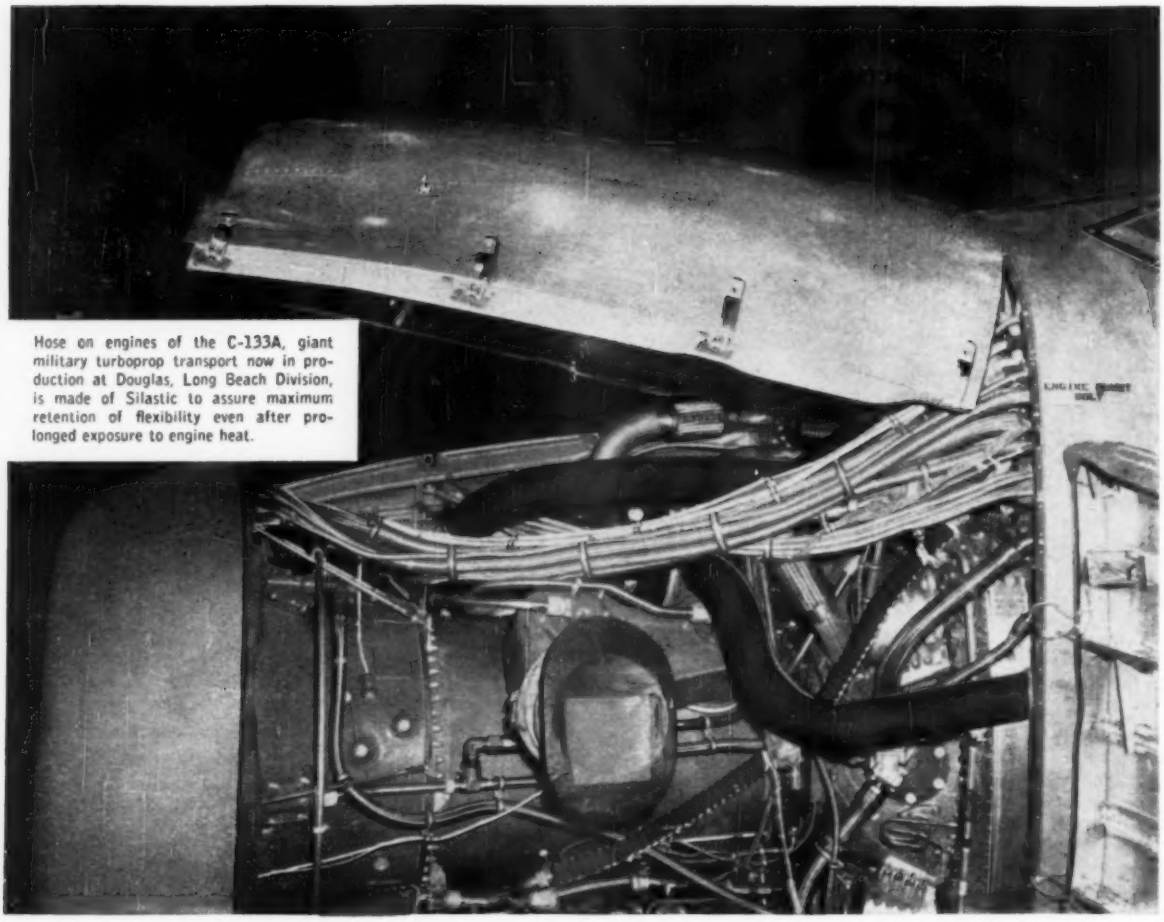
**ALSO AVAILABLE**

| Double-Pole Normally Closed | Double-Pole Normally Open | Double-Pole Double-Throw |
|---|---|---|

**Get full details:**
**WRITE FOR DATA SHEET NO. H1M-9**

ELECTRO SNAP

**ELECTRO-SNAP SWITCH & MFG. CO.**
4232 WEST LAKE STREET
CHICAGO 24, ILLINOIS



Hose on engines of the C-133A, giant military turboprop transport now in production at Douglas, Long Beach Division, is made of Silastic to assure maximum retention of flexibility even after prolonged exposure to engine heat.

# SILASTIC hose stays flexible at 500 F

SILICONE RUBBER

Whether the temperature registers −130 F or +500 F, Silastic* stays elastic . . . keeps its shape. That's why this versatile Dow Corning silicone rubber is ideal for jet engine hose, de-icing ducts, fuel tank ventilating hose and alignment couplings on jet engine tubing. Leading rubber companies fabricate Silastic hose, ducts and tubing in virtually any size, cross-sectional shape or color.

**Get latest data on Silastic**

**Mail coupon today**

Dow Corning Corporation, Dept. 0909 b
Midland, Michigan

Please send me the latest data on Silastic

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

**Typical Properties of Silastic for Hose, Ducts and Tubing**

| | |
|---|---|
| • Temperature range, °F | −130 to 500 |
| • Corrosion | Non-corrosive to metal |
| • Pressure range | Low pressure |
| • Oil resistance | Dependent on type of oil |

• Light weight • Weather resistant • Flexible

*T. M. REG. U. S. PAT. OFF.

**If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.**

first in silicones — DOW CORNING SILICONES

**DOW CORNING CORPORATION • MIDLAND, MICHIGAN**

# FACTS

about

**NEW DEPARTURE**

**BALL BEARINGS**

## FOR AIRCRAFT TURBINES

Split Inner Ring Main Shaft Ball Bearing

High speeds, high temperatures and heavy loads . . . both radial and thrust . . . characterize bearing applications for turbines used in present ultra-fast aircraft.

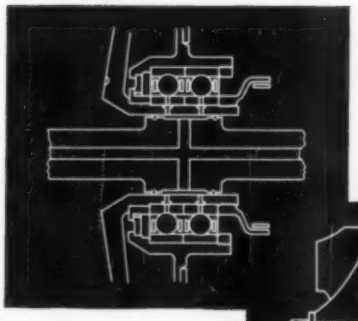
New Departure's Aircraft Bearing Research Program has produced ball bearings for highly satisfactory operation in small, medium and large turbines and their accessories.

Under this program, ball bearings of different steels dimensionally stabilized for high-temperature operation have been developed and produced. Needs for bearings with high-thrust capacity and varied lubricating methods have been met. And, bearings with various geometrical specialities to satisfy difficult mounting and operational requirements were designed.

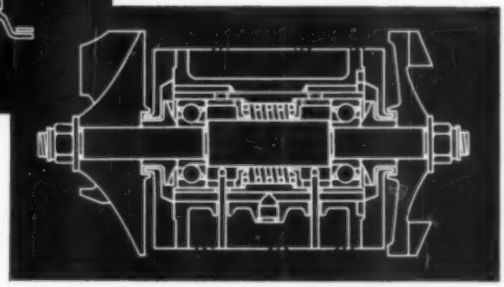
Beyond this, New Departure is working on bearing developments for the more powerful, faster aircraft of tomorrow.

**For further details, send for Folder TB, on turbine bearings.**

Accessory Ball Bearings



LEFT: Split Inner Ring Bearings on Turbine Main Shaft



RIGHT: Typical Installation of Ball Bearings in a Refrigeration Turbine

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

# 2220 HANDS *work together at Chandler-Evans . . . to produce the finest*

*AIRCRAFT FUEL CONTROL SYSTEMS and COMPONENTS*

*Here at the Chandler-Evans plant in West Hartford, young, aggressive and imaginative engineers join forces with seasoned specialists who contribute valuable experience gained in years of significant achievement. Here, RESEARCH works in completely equipped, modern laboratories to provide the advanced data on which ENGINEERING bases always newer, finer designs. And PRODUCTION converts these designs into the precision fuel control systems and aircraft components that have played a vital part in establishing so many of the important "firsts" in aviation's progress.*

**When you work with CECO, your projects are in good hands!**

## *To Young Engineers*

Chandler-Evans offers *careers* in Creative Engineering. Here – for aggressive young men capable of original thinking who want to see their ideas realized – are opportunities to work under experienced specialists on important developmental projects that will provide full scope for your abilities and help you grow in your profession. Write directly to our Chief Engineer, Mr. A. M. Wright.

CECO *Chandler-Evans*

**CHARTER OAK BOULEVARD, WEST HARTFORD 1, CONN.**

*Makers of Jet Aircraft Accessories Produced Today to Meet Tomorrow's Progress*

SEPTEMBER 24, 1956

# AVIATION WEEK

VOL. 65 No. 13

New York 16—330 W. 42nd St., Phone: LOngacre 4-3000 (Night LO 4-3035)

**Editorial Offices** Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630

Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL)
David A. Anderton
WASHINGTON.....Cecil Brownlow
NEW YORK.William Gregory, James J. Dailey
LOS ANGELES.Irving Stone, Richard Sweeney
ENGINEERING.....Robert H. Cushman, Russell Hawkes
AVIONICS.....Philip J. Klass
CONGRESS.....Katherine Johnsen
MILITARY....Claude O. Witze, Evert Clark
TRANSPORT....Craig Lewis, Glenn Garrison, L. L. Doty
EQUIPMENT.....G. L. Christian
BUSINESS FLYING.....Erwin J. Bulban
ART EDITOR.....Lawrence J. Herb
ASST. ART EDITOR.....Robert G. Young
EDITORIAL PRODUCTION....Jerome E. Kelley
EDITORIAL ASSISTANTS
Bernie Lang, Betty Hein
LIBRARIAN.....Jeanne Rabstejnek

FOREIGN NEWS SERVICE

EDITOR.....John Wilhelm
LONDON..... William J. Coughlin
PARIS.....Robert E. Farrell
BONN.....Gerald W. Schroder
MEXICO CITY.....John H. Kearny
RIO DE JANEIRO.....Peter Weaver
TOKYO.....Dan Kurzman

DOMESTIC NEWS BUREAUS

ATLANTA 3.....801 Rhodes-Haverty Bldg.
CHICAGO 11.....520 N. Michigan Ave.
CLEVELAND 15.....1510 Hanna Bldg.
DETROIT 26.....856 Penobscot Bldg.
HOUSTON 25.....1303 Prudential Bldg.
LOS ANGELES 17.....1125 West Sixth St.
SAN FRANCISCO 4.....68 Post St.
WASHINGTON 4...1189 National Press Bldg.

SALES

ADVERTISING SALES MANAGER
E. P. Blanchard, Jr.
PROMOTION and RESEARCH MANAGER
W. H. Jack
ATLANTA.....R. H. Powell
BOSTON.....A. C. Boughton
CHICAGO and ST. LOUIS.....J. S. Costello, F. E. Bauman
CLEVELAND.....H. P. Johnson
DALLAS.....Gordon Jones, Douglas Billian
DETROIT.....C. A. Ransdell
LOS ANGELES.....C. F. McReynolds, D. T. Brennan
NEW YORK.....M. J. Storz
PHILADELPHIA...W. S. Hessey, J. D. Willis
SAN FRANCISCO.....William Woolston

BUSINESS

BUSINESS MANAGER.....J. G. Johnson
PRODUCTION MANAGER.....W. V. Cockren

RESEARCH AND MARKETING

Mary Whitney Fenton, Joan Read, Judith P. Wheeler

**First Vanguard Tests Scheduled This Fall..... 26**
▶ Scientists meeting in Rome are filled in on Vanguard's first steps set for autumn; hear of Soviet project.

**'Radar Cocoon' to Surround Aircraft..... 37**
▶ Collins airborne proximity warning system to throw radar cocoon around plane to stave off collision.

**Future Design Spurs Aircraft Manufacturers..... 50**
▶ Advanced aircraft designs engineered in the next decade will tax the ingenuity of the manufacturing team.

MISSILE ENGINEERING

Irvine Asks for Super Materials..... 30
Hypersonic Rocket..... 30
Napier Spurs Rocket Operations..... 59
Hot Shot Tunnel Hits Mach 15..... 67
Snark Details at Aircraft Show..... 95

AERONAUTICAL ENGINEERING

B-58 Flight Simulated..... 28
X-2 Sets Altitude Record..... 29
USAF Maps Magnetic Field..... 31
Algerin Challenges Helicopters..... 88

PRODUCTION ENGINEERING

Maintenance Trainer..... 64
Production Briefing..... 59

AVIONICS

Vortac Catches Industry Off Balance 69
Avionic Sales, Earnings Up..... 69
500C Avionic Devices Shown..... 73
Filter Center..... 74
Expansions in Avionics Industry..... 75
New Avionic Bulletins..... 78

FINANCIAL

Certificates of Necessity..... 79
USAF Contracts..... 79
Army Contracts..... 98
Navy Contracts..... 98

TRANSPORT

ICAO Begins Navigation Review..... 38
IATA Tackles Jet Problems..... 39
ATA Fare Adjustments..... 40
Hughes Hopes to Lend $10 Million.. 41
Reduction Planned in Reserve Fleet.. 41
Congress Group Joins Stock Probe.. 41
Report Favors Transport Census.... 41
Dallas Case Limited to California.... 41
CAB Reports Accidents..... 43
New Argentine Airline..... 43
ATA Official for Blanket Control..... 45
Pan Air Buying DC-7s..... 45
Shortlines..... 45
Airline Observer..... 47

BUSINESS FLYING

Cessna Unveils Model 620..... 32

MANAGEMENT

Fanouf Replaces Bell..... 28
Navy Orders New Plane From NAA... 28
USAF B-52s Grounded..... 30
B-47s to Visit Australia..... 30
India Orders 25 Folland Gnats..... 31
Who's Where.....23, 101
Industry Observer..... 23
Washington Roundup..... 25
News Digest..... 34

Calendar..... 4
Letters..... 116

EDITORIAL

IATA Faces the Issues..... 21

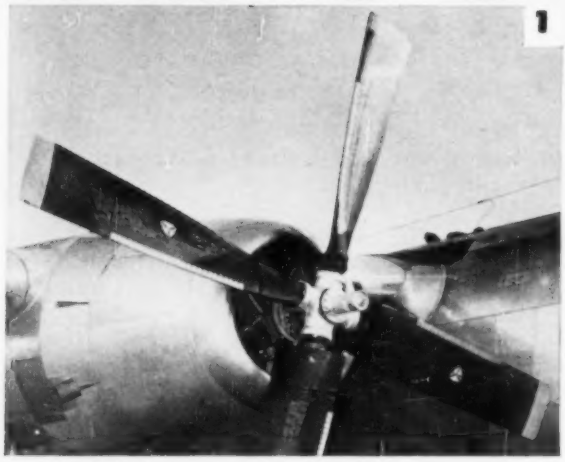
**COVER:** Convair R3Y-2 Tradewind refueling Grumman F9F Cougar jet fighters. Four engine turboprop airplane can service eight fighters from wing tanks, has four tunnel-shaped drogues housed in reinforced plastic pods 18 ft. 7 in. long and 4 ft. 3 in. wide. Each pod has built-in mechanism to actuate drogue. When used as a transport, R3Y carries 25 tons of cargo. 103 passengers or combination load. Unlike original version, R3Y-1, which has only cargo door at side, R3Y-2 also has bow-loading door to take on trucks, guns and other cargo.

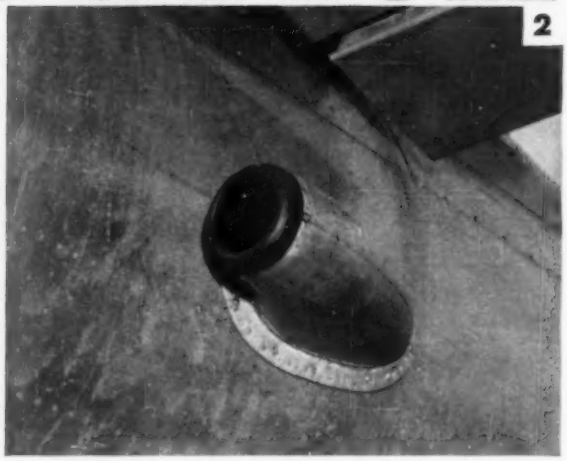
Picture Credits:
32, 33—E. J. Bulban.

67,374 copies of this issue printed

AVIATION WEEK • SEPTEMBER 24, 1956 • Vol. 65, No. 13
Member ABP and ABC

# B.F.Goodrich



## 4 hot recipes that do away with icing

SOME of these recipes for ice protection require more heat than others. But all of them call for B. F. Goodrich electrically heated rubber to give just the right amount of heat—in the right places.

Notice how B. F. Goodrich heated rubber fits snugly around the tricky curves and corners on these different airplane parts. And how the ice problem was solved in each case:

1. *On propellers,* it prevents ice from reducing propeller efficiency and cutting down plane speed.
2. *On reel oil coolers,* like these on the KB-50 (Hayes modification), it keeps ice from choking off vital air supply.
3. *On air intakes,* it insures smooth flow of air to engine parts and cabin heating system.
4. *On pitot mast,* it prevents ice from clogging air speed indicator and giving faulty readings on instrument panel.

In B. F. Goodrich heated rubber, resistance wires are sandwiched between rubber plies, then vulcanized into a flexible, lightweight unit. It can be easily cemented on the part or attached mechanically.

Other heated rubber applications for ice protection or heat control include antenna masts, wing and empennage leading edges, spinner domes, jet engine air intakes, and radar equipment.

If you are looking for the most efficient method of applying spot heat, consult a B. F. Goodrich engineer. He'll be pleased to help.

**B. F. GOODRICH AVIATION PRODUCTS, a division of The B. F. Goodrich Company, Akron, Ohio.**

B.F.Goodrich

**AVIATION PRODUCTS** Tires, wheels, brakes • De-Icers • Inflatable seals • Fuel cells • Avtrim • Heated Rubber • Pressure Sealing Zippers • Rivnuts • Plastilock adhesives • Hose and rubber accessories

# EDITORIAL

## IATA Faces the Issues

The skirling of bagpipes has hardly died away in the misty air atop Edinburgh Castle, but delegates to the annual general meeting of the International Air Transport Assn. can already hear the click of castenets and trumpet fanfares of the bull ring that is in store for their next meeting in Spain. The 12th annual general meeting in Edinburgh was notable for several reasons.

First, there was the superb hospitality of the host British airlines—British Overseas Airways Corp., British European Airways, Hunting Clan and Airwork. Everybody who participated in the IATA program, from the time of the stirring military tatoo on the parade ground of Edinburgh Castle to the final formal ball, will join us in congratulating the British host airlines on a job well done.

Second, there was a marked air of determination to face squarely the problems looming in the jet transport era and to get on with the job of preparing for them now, both technically and economically. The technical side of IATA is well into its program to prepare for the jet age. They are working closely with the International Civil Aviation Organization. The full text of the technical committee report presented by Capt. Anselme Vernieuwe, executive vice president of Sabena Belgian World Airlines, merits close study by both operations and management executives of airlines the world over.

### No Place for Political Boundaries

We think one of the most significant portions of this report is the firm stand taken to abolish air traffic control areas based upon national political boundaries. This use of political boundaries in air traffic control procedures has no place in commercial aviation, even with the 300 mph. speeds of current piston powered transports. It will become downright dangerous with the advent of 400 mph. turboprop airlines and 500 to 600 mph. turbojet transports. As the IATA technical report mentioned, even now an aircraft has often passed through one of these artificial control areas before it has received proper clearance. The combination of aircraft speed and communication delays makes this a routine occurrence in European airline operations.

The technical committee also recommended that future air traffic control systems should be based upon area rather than route concept. We already can see how the technical capabilities of current aircraft, such as the Lockheed 1649, Douglas Seven Seas and Bristol Britannia, have made traditional airways concepts obsolete. A switch from route to area control is an absolute must if airline operators are to achieve maximum operational flexibility from their new equipment and give the travelling public the most efficient and economical service.

Another point worth noting in the technical committee report is its plea for international cooperation in the development of new navigation and traffic control equipment, with large scale evaluations conducted jointly by all the governments involved. This contrasts with the past procedure of developing national systems to the point of operational use and then fighting it out on a nationalistic basis all over the world to plug a particular equipment system. Airline pilots now flying international routes can testify that the old system has not yet produced the results they really need.

During the past six months, there has been an encouraging trend in civil aviation business to get down to hard headed thinking and action on jet age problems. We have seen evidence of this in the recent reorganization of the Civil Aeronautics Administration, in the special group created at ICAO's Caracas meeting headed by Dr. Edward Warner and by the technical discussions of IATA.

### Economic Revolution Pending

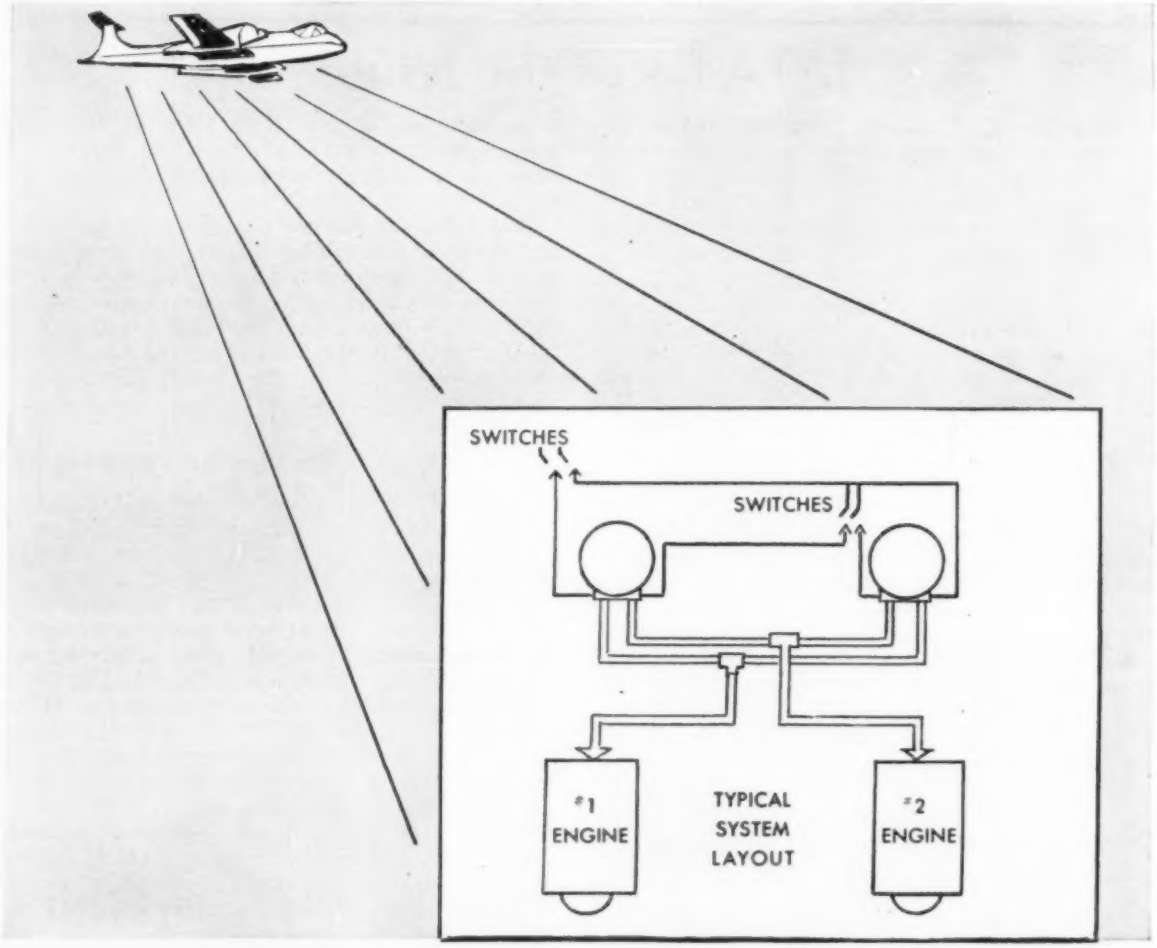
If this spirit and energy continues over the next few years, the advent of jet transports will come as a smooth operational transition that will provide better service to the traveling public with lower fares, and not the noisy chaos that has been predicted by some pessimistic prophets. In addition to the technical revolution wrought by gas turbine powered transports, there already are signs that an economic revolution is in the making as a result of their capabilities. It was most encouraging to hear Lord Douglas, chairman of BEA and current IATA president, call for the same frank energetic approach to the economic problems of the jet transport era as that already being displayed by technical groups.

The first rumblings of a jet age economic revolution came last summer with new low fares for third-class-type travel proposed by Pan American World Airways for transatlantic routes and the cut-rate, excursion-type fares proposed by Trans World Airlines. The Cannes traffic conference took a step in the right direction, although there will be considerable argument as to whether it was far enough or fast enough. There is little doubt now that some very basic revisions will have to be made in the international rate structure to accommodate the new demands of jet age traffic.

As Lord Douglas pointed out, there must be a place for the turboprop transport in the jet age fare structure to allow both the operators and the traveling public to take full advantage of its lower operating costs. "This is where I think the turboprop comes back into the picture again," he told the IATA Edinburgh meeting. "I think it probable that in practice this kind of aeroplane will offer a level of operating costs significantly lower than those of pure jets. If this were proved to be the case, we in IATA will face a tariff problem perhaps more difficult than any we have met before. For it would surely be the duty of airlines in IATA, not only to offer the traveling public the advantages of increased speed which introduction of the pure jet makes possible, but also to give the public a choice of slower service at lower fares. This may soon become the most important, most difficult issue IATA has ever had to tackle."

As long as IATA can be as forthright and courageous in facing future issues as the atmosphere of the twelfth annual general meeting indicated, we think the traveling public can look forward to getting better service at lower fares in the jet age.

—Robert Hotz




*From Kidde:*

# Push-button fire fighting!

The extinguishing agent: $CF_3BR$, CB, MB, $CF_2BR_2$ or $CO_2$ . . . pressurized in "Main" and "Reserve" spheres of strong, lightweight steel.

The method of operation: Manual actuation (cable or electrical switch) by the pilot.

The discharge time: Almost instantaneous—from .5 to .9 of a second.

Designed and perfected by Kidde aviation engineers, specialists in aircraft fire fighting problems for more than 25 years, Kidde Nacelle Fire Extinguishing Systems offer dependable, fast-acting protection plus almost unlimited installation flexibility.

For recharging and service, Kidde has strategically located stations in the United States, Canada and throughout the world.

For further protection: The Kidde Aircraft Continuous Automatic Resetting Fire Detector, whose sensitive, nacelle-installed element immediately signals the pilot at the first sign of fire or abnormal engine overheat.

Kidde engineers are now working hand in hand with those interested in aircraft fire protection and safety, developing new extinguishing agents, corrosion inhibitors and special systems for ambient temperatures up to 250° F. Other Kidde aircraft safety projects include high pressure oxygen equipment, inflation equipment, flotation equipment, crash fire prevention systems, purging and pressurization systems.

If you have a problem involving aircraft safety, contact the manufacturer of more than 95% of the aviation fire extinguishing systems installed on U. S.-built planes. Write Kidde today.

**Kidde** **Walter Kidde & Company, Inc., 918 Main St., Belleville 9, N. J.**

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

# WHO'S WHERE

## In the Front Office

**Trevor Gardner**, president, **John McKean**, treasurer, and **Duane O. Wood**, a director, Hycon Aerial Surveys, Inc., Pasadena, Calif. Messrs. Gardner and McKean hold the same posts with a parent company, Hycon Manufacturing Co.

**Donald K. Phillips**, general partner of E. F. Hutton and Company, a director of Doman Helicopters, Inc., Danbury, Conn.

**Charles E. Doughty, Jr.** and **Patrick J. Tuohy**, vice presidents, Flightex Fabrics, Inc., New York, N. Y.

**Adm. Harry D. Felt**, USN, Vice Chief of Naval Operations, Washington, D. C. Adm. Felt relieves Adm. Donald B. Duncan.

**Ernest N. Ljunggren**, former head of the Air Research and Development Command's Directorate of Systems Plans, executive vice president of the Gudeman Co., 1224 S. Courtland Ave., Park Ridge, Ill.

**John E. Markley, Jr.**, executive vice president, International Electronics Research Corp., Burbank, Calif.

## Honors and Elections

The American Society for Metals will honor the following men during the forthcoming 38th National Metal Exposition and Congress: **Edgar H. Dix, Jr.**, assistant director of research at the Aluminum Company of America's Aluminum Research Laboratories, the Albert Sauveur Achievement Award for his outstanding work in aluminum alloys research. **William H. Eisenman**, national secretary of the ASM, the ASM Gold Medal for "advancing metallurgy from an art to a science." **Charles M. White**, board chairman of Republic Steel Corp., ASM's Research Medal for his consistent sponsorship of metallurgical research and development. **Dr. Alexander R. Troiano**, professor and head of the Department of Metallurgy at Case Institute of Technology, **Dr. William J. Barnett**, General Electric Co. (Evandale, Ohio), and **Dr. Richard P. Frohmberg**, North American Aviation Corp., the Henry Marion Howe Medal Award. **Dr. Ernest P. Nippes**, professor of metallurgy at Rensselaer Polytechnic Institute, ASM's Teaching Award.

## Changes

**Robert L. Kunzig** has resigned as assistant to Civil Aeronautics Board Chairman **James R. Durfee** to accept a special campaign appointment with the Republican National Committee.

**Louis J. Springer**, assistant to the executive vice president, Airwork Corp., Millville, N. J.

**M. Paul Andro**, special assistant for contracts, Ford Instrument Co., Division of Sperry Rand Corp., Long Island City, N. Y.

**John R. Church**, aviation sales coordinator, AC Spark Plug Division, General Motors, Flint, Mich. Also: **Donald A. Foley**, aviation sales engineer.

*(Continued on page 101)*

# INDUSTRY OBSERVER

**► Navy's new Sparrow III (air-to-air) missile will go into full-scale production next year at Navy's Bristol, Tenn. facility where Sperry-Rand now is building Sparrow I missiles. Raytheon, which developed the Sparrow III, will take over management of Bristol facility from Sperry as Sparrow I production is phased out.**

► Earth satellite, which Soviet Russia recently announced it will launch during the International Geophysical Year, may be given a polar orbit to provide data to complement that obtained from the U.S. satellite's eliptical orbit. Russians agreed to use satellite instrumentation that is compatible with U.S. satellite to permit both nations to obtain data from the other's vehicle. U.S. scientists reportedly learned of Russian satellite plans prior to official Soviet announcement.

**► Cessna T-37A jet trainer cockpit is being remodeled to provide the student with a complete instrument panel, with the instructor getting basic instrument layout. Engine instruments are centered in the side-by-side trainer. An 11-plane contract has been completed by Cessna and work on a second USAF contract for 20 aircraft is under way. First plane of the second contract will be delivered this month.**

► Reassessment of Russian Bear credits the bomber with a maximum speed approaching 650 mph. with power supplied by four 12,000 eshp. turboprops driving contra-rotating supersonic propellers. Other data: cruise speed is 550 to 570 mph. at 50,000 ft.; range is 8,000 mi.; gross weight about 330,000 lbs.; span, 180 ft.; length, 15 ft. Latter dimensions confirm earlier AVIATION WEEK estimates.

**► Simplified helicopter rotor system developed and flight tested by Bell Aircraft Corp.'s Texas Division eliminates the cross-bar weight and reduces number of parts in the system.**

► De Havilland of Canada's DHC4 twin engine transport will have the capacity of a DC-3 and the landing and takeoff characteristics of the company's Otter. The aircraft being designed as a troop transport for the Royal Canadian Army will gross 27,000 lb. with a payload of 7,500 lb. De Havilland held up development of the aircraft pending the military contract, but civilian sales prospects are so bright that the company probably would have gone ahead on its own.

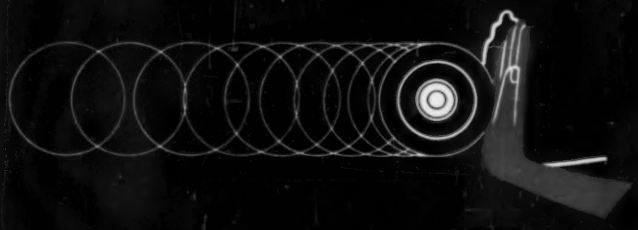
**► Royal Air Force leaders believe that manned bombers will be required at least until 1970, with a strong possibility that the need will continue beyond that date. However, there appears to be no definite plan for a Mach 2 bomber development in the British aircraft industry.**

► Army has under serious consideration a proposal by Cornell University's aviation crash injury research group for a three-year study of helicopter crash injuries. Contract is expected in the near future. It would be funded by the Army Transportation Corps and administered by the Office of Naval Research.

**► Lockheed F-104A is being flown by General Electric crew at Edwards AFB., Calif., in continuing test program of the company's J79 turbojet engine. Specific testing of the engine in a production aircraft gives General Electric valuable data for possible powerplant improvement.**

► Delegation headed by Col. Jose Saul Guerrero, commander in chief of the Venezuelan air force, is studying purchase of military aircraft from Avro Aircraft Ltd., Toronto, and Canadair Ltd., of Montreal. Venezueleans have shown interest in Canadian-built Sabre powered by Orenda engine similar to those recently purchased by the Colombian and South African air forces.

**► Snecma's Atar 8 turbojet engine has entered the flight-test stage. Atar 8 has nine compressor stages in contrast to seven and eight on earlier models. Static thrust is rated at approximately 9,200 lb. Afterburner model, the Atar 9, is rated at 12,000 lb. for the first stage.**



## *hytrol*

The *Accepted* Anti-Skid Braking System *Standard Equipment* on the B-47, B-52, B-66, A3D, RF-84F, F-100C&D, F-107, C-133A, C-130A. Tested on thirty-five other types of aircraft.

## FUEL GATE VALVES

All standard sizes. Moving seals are teflon. Sealed actuator protects motor. Explosion proof.

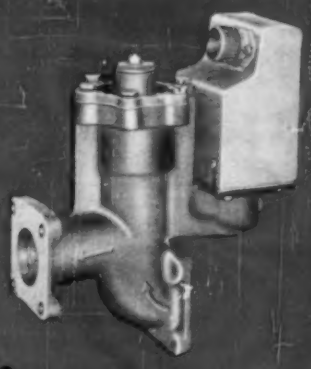
# 4 good reasons why...

*every fighter, every bomber,*

*every transport is* **HYDRO-AIRE** *Inc.* *equipped*

3000 WINONA AVE., BURBANK, CALIF.

*the aviation subsidiary of* CRANE *Co.*



## HOT AIR VALVES

Types include solenoid pilot valves, pneumatically operated hot air valves, motor operated butterfly valves.

## HY-$^{V}/_{L}$ FUEL PUMPS

High vapor/liquid ratio fuel booster and transfer pumps. Outstanding performance . . . exceptional economy. Now flying on the F8U-1, F-101A, F-5D, B-52, the Regulus, the Navaho.

# Washington Roundup

## Less Money for Small Business

Senate Small Business Committee is protesting the downward trend in the portion of military contracts being awarded small firms. A staff report of the committee notes that, during the first nine months of Fiscal 1956, only 19.6% of the total dollar value of defense business was awarded to small business as compared with 21.5% during Fiscal 1955.

In its periodic report, the Department of Defense reported some of the reasons why the full potential of small business contracts are not going to small business. The Air Force, for example, reported that during a nine-month Fiscal 1956 period, 42.4% of the full potential of small business contracts did not go to small firms because—the small firms did not bid for the contracts, the bids were not low bids, they did not meet specifications.

## Man Contacts Mars

Man's first radio contact with Mars was reported last week. The same Naval Research Laboratory team that picked up radio radiation from Venus earlier this year detected signals from Mars at 3 cm. with a 600-in. radio telescope. More than 50 measurements were necessary to establish the certainty of the contact. Earlier attempts to detect the red planet at 1.86 cm. were frustrated by cloudy weather. First reception of planetary radio emission to be reported was accomplished by Carnegie Institution of Washington scientists at nearby Maryland installation. In the summer of 1954, they picked up intermittent, static-like signals from Jupiter that were millions of times stronger than thermal radiation from Jupiter should be. They are still unexplained.

The Naval Research Laboratory also made news last week by achieving the first controlled release of atomic energy in the Washington area. The Army has had a transportable power and heat plant under construction at Ft. Belvoir, Va., for two years and another type has just been authorized for the University of Maryland, but the Navy's "swimming pool" reactor already is undergoing calibration and checkout.

## Political Notes

Most of the key figures on aviation affairs in the House of Representatives will return with the new Congress next year.

• **Rep. Clarence Cannon** (D.-Mo.), chairman of the Appropriations Committee, has no opposition. Vocal critic of Defense Secretary Charles Wilson during the last session, Cannon is a strong supporter of strategic air power and, in recent years, has tempered his opposition to naval carrier aviation.

• **Rep. George Mahon** (D.-Tex.), chairman of the Appropriations Subcommittee on the Armed Services, also is without opposition. During recent years, he has kept a watchful eye on military procurement practices, and directed staff investigations.

• **Rep. John Taber** (R.-N. Y.), ranking Republican member of the Appropriations Committee, has only token Democratic opposition in his traditionally Republican district. Budget cutting, defense and otherwise, is his major specialty.

• **Rep. Carl Vinson** (D.-Ga.), chairman of the Armed Services Committee and a leader on defense policies during his 36 years in the House, is without opposition. So is **Rep. Edward Hebert** (D.-La.), chairman of the Armed Services Investigating Subcommittee, which made a comprehensive study of procurement and profit policies of military airframe contracts.

• **Rep. Dewey Short** (R.-Mo.), ranking Republican member of the Armed Services Committee, has noteworthy opposition from Charles Brown, 35, former radio and television station manager. Short, however, plans an active campaign and is expected to win. **Rep. William Hess** (R.-Ohio), ranking Republican on the Armed Services Investigating Subcommittee, faces a stiff re-election fight in his marginal district.

• **Rep. Percy Priest** (D.-Tenn.), chairman of House Commerce Committee, and **Rep. Oren Harris** (D.-Ark.), chairman of the Subcommittee on Aviation, have no opposition.

However, outcome of the elections of the three top Republicans of the House Commerce Committee is uncertain. **Rep. Charles Wolverton** (R.-N. J.), ranking Republican member, is bucking a strong and entrenched Democratic state organization. **Rep. Joseph O'Hara** (R.-Minn.), who became second ranking Republican on the death of Rep. Carl Hinshaw, is confronted with an uphill fight against Democratic-Farmer Laborite Harold Zupp.

The outcome of the Sept. 9 race of **Rep. Robert Hale** (R.-Me.), third ranking Republican, still is not final. The last count gave Hale a victory by 29 votes.

## Airworthiness Review

Civil Aeronautics Board staff hopes to have its Airworthiness Review draft release ready by mid-October. Proposed amendments to the Civil Air Regulations in the draft release will be based upon discussions held earlier this month at the annual airworthiness review. Industry and government technical experts, including delegates from eight other nations, discussed proposed changes in regulations during a week-long meeting in Washington.

Chief point of interest at the meeting was the CAB's proposed new performance rules for turbine powered transports, but discussion was inconclusive and confined largely to clarification of language in the proposal—Draft Release 56-20. Main drag on the conversations was the fact that the airlines and manufacturers declared themselves unprepared to discuss the plan. They have asked the CAB to move the Oct. 15 deadline for comments on 56-20 back to Jan. 15. An Air Transport Assn. official told the meeting that the airlines and manufacturers are developing a work program to obtain data and apply them to various routes in order to determine the effect of the rules proposed in 56-20.

## New Money for IDA

Defense Department's Weapon Systems Evaluation Group has negotiated a $1.7 million contract with the Institute for Defense Analysis, the new organization formed by a group of universities to perform operation analyses for the Joint Chiefs of Staff and the Assistant Secretary of Defense for Research and Development (AW May 21, p. 29). The contract runs through next June.

Trustees of the institute have named Maj. Gen. James McGonnack Jr. (USAF, ret.) as president.

—**Washington Staff**

# First Vanguard Tests Scheduled This Fall

## Rome space congress told of Vanguard satellite's first steps, Russian plans to launch own vehicle.

By David A. Anderton

**Rome**—First tangible steps toward space flight will be taken this fall with the launching of the first Project Vanguard test vehicle. This announcement, coupled with confirmed knowledge that the Soviet Union plans to launch a satellite as part of its contribution to the International Geophysical Year, highlighted the Seventh Congress of the International Astronautical Federation.

This congress, as others before it, was a study in sharp contrasts between the highflown theories of astronautics and the limited experimental data available today. The 450 scientists, engineers and technicians gathered at the congress, more than double last year's attendance, heard 43 papers added to the literature of this growing field of science.

About one-third of the presentations were concerned with the problem of artificial satellites; the rest covered the spectrum of space flight from chemical kinetics to a proposal for a mammoth manned satellite.

### Vanguard Details

The kaleidoscope of colorful cosmic thinking was a bright background for the dirty gray facts of cosmic ray damage. The few bits of experimental data on weightlessness, now experienced only briefly during controlled jet flights, underscored the problem facing space voyagers before undertaking the suggestion of another scientist for a one-year exploration tour from earth to Mars to Venus and back home again.

The first component of the three-stage Vanguard satellite vehicle to be tested will be the third stage solid propellant unit now under development at the Grand Central Rocket Co. and the Allegany Ballistic Laboratory. The 13th Martin Viking rocket built but not yet fired for the Navy's upper atmosphere research will be launching vehicle for the tests. It will mount the third stage of the proposed Vanguard vehicle in place of the standard Viking nose cone.

### November Firing

First firing is scheduled for November at the Cape Canaveral launching site near the Air Force Missile Test Center at Patrick AFB.

At least three different test rounds will be fired before the Vanguard satellite program begins. Two of the three will be modified Viking rockets and the third will be the aerodynamic prototype of the Vanguard itself. It will not, however, be an orbital vehicle.

A Convair F-102 was suggested as a means of launching a small satellite vehicle by A. C. Robotti of the Italian delegation. He estimated the performance of the two-stage Bumper/Wac combination that set an altitude mark of 250 mi. back in 1950 on the assumption that an equivalent missile combination could be launched at an altitude of about 46,000 ft. and an initial speed of about 335 mph. Under these conditions the bumper equivalent could be expected to top 360 mi. for a 45% improvement. Robotti redesigned the Bumper/Wac into a delta-winged, two-stage vehicle supported underneath the F-102 on two pylons. A wheeled take-off dolly supported both plane and vehicle during the rocket-assisted takeoff run.

But the vehicle itself would be taken off with empty tanks and refueled in the air from a tanker plane. Contact point would be at the nose of the F-102, and the fuel and oxidizer lines would run from there through the wing pylons to the vehicle tanks.

### Space Coverage

**This on-the-spot report from the Seventh Congress of the International Astronautical Federation in Rome continues Aviation Week's annual coverage of this important event.**

**The Federation is composed of member societies from 21 nations founded ". . . to promote and stimulate the achievement of space flight as a peaceful project."**

**Formed in Paris in 1950 at the first international meeting of rocket and astronautical groups, the IAF now numbers approximately 12,000 members. All major fields of science and technology are represented. A high percentage of the IAF membership is composed of professional men.**

**The council of the federation has appointed committees to carry out some of the tasks assumed by the organization in its constitution. Among them: publication of an International Astronautical Journal, Astronautica Acta; preparation of a glossary of astronautical terms; recommendations for standardization of astronautical nomenclature and library classification systems.**

**Permanent headquarters of the IAF including the secretariat, an archive and library, is in Baden, Switzerland.**

### Weightlessness

Contrasting to earlier reports of unpleasant sensations during short periods of weightlessness were the experiences of 16 subjects who were flown in a Lockheed T-33 for periods of 10 to 30 seconds of weightlessness. Most of the subjects felt pleasant, said Dr. J. Gerathewohl of the USAF School of Aviation Medicine. Some of the passengers felt sensations of motion, but they were not bothered by them. Said one: "The weightless condition brought on an extreme feeling of well-being and comfort . . . I could feel my body relaxing. Actually, I've never been so bloody comfortable in all my life."

All were not that happy; some of the subjects fought nausea most of the ride and afterwards were very fatigued. Concluded Dr. Gerathewohl: "We believe selected crews (of future space ships) will be able to perform efficiently under sub and zero gravity conditions.

### Solar Power

Hydrogen production plants in space, producing liquified gas from raw materials ferried from earth, were proposed by Krafft Ehricke, chief of preliminary design for Convair Astronautics Division. Such chemical plants would be one means of reducing overall cost of manned space flight. By producing the fuel in a satellite, the cost of ferrying propellants from earth to orbital launching points of space ships would be greatly reduced. The concept is an extension of earlier proposals by Ehricke and others for a systematic expansion into space flight by first establishing a satellite as a launching base and then using a ferry fleet to supply the satellite.

Supply cost for such a system is staggering in view of the requirements for space flight; for example it would require 100 lb. of propellant and about 20 lb. of structure on the cargo rocket just to take one pound of propellant out to the orbit.

One possible way to reduce overall system costs is to use lightweight propellants such as hydrogen. Solar heat could be used in the hydrogen plant as the sole source of power and the operation could be completely automatic, with only occasional human supervision.

### Orbital Calculations

A major contribution to the calculations of satellite motions was made by John Denike of Martin's advance design department. The Vanguard program required data on control accuracy

early in the program and that data was related to the guidance and tracking accuracy requirements. Orbital analysis was the only way to get those requirements and the method chosen would have to produce accurate time-position data, life-time data and the dynamics of the orbital plane. Most earlier studies have assumed restricting factors which simplify the analysis and do not necessarily improve the quality or value of the results. Denike's approach included the effect of the non-circularity of the orbit, the drag of the atmosphere and the non-spherical shape of the earth.

Within the framework of these conditions, four basic equations were used to derive the mechanics of motion.

A light weight Moon vehicle fired from a Skyhook balloon at 7,000 ft. altitude was proposed by Kurt Stehling and R. Foster of the American delegation. Vehicle has three stages: a cluster of solid propellant rockets with a total impulse of 4,720,000 lb./sec. forms the first stage; the second stage is also a solid propellant rocket of 280,000 lb./sec. and the third stage, also a solid rocket, has a total impulse of 11,000 lb./sec.

This combination could propel a four pound payload beyond the neutral gravity point between the earth and the Moon. From there the payload would fall to the Moon under the influence of lunar gravity.

Shipboard launching at relative zero wind was envisioned as a necessity. It also might be necessary to stabilize the suspension platform with rockets or flywheels to guarantee vertical alignment at firing. The vehicle would fire right through the balloon; earlier experiments with upper atmosphere launchings from balloons have shown that balloon resistance is so slight that no deviation of the rocket occurs.

Authors suggested that although a four pound payload was tiny, scientists might put out extra effort to develop instrumentation for such a package simply because it offered the first chance to make the Moon. Payload might include proximity fuse triggering flash or fluorescent powder to mark the impact point on the lunar surface. A single purpose telemetering set might be useful on the way, but it would not survive the impact on the Moon.

Project success, which appears completely feasible, is predicated on firing of several rounds with nearly a guarantee that one would make the trip.

The IAF now numbers 21 member nations. During the early business sessions of the federation, an application was received for membership from A. Sedov, on behalf of a commission of the Academy of Sciences of the USSR. Added to the Russian application were those of astronautical societies in Poland, France and Germany.

This growth of the federation, whose individual members now number close to 12,000, was an encouraging note to the delegates. But in spite of repeated offers by the federation to help during the International Geophysical Year, positive response from the U. S. Academy of Science is still lacking and the federation feels the rebuff keenly. The IAF also failed to obtain membership in the International Council of Scientific Unions. One of the problems of an outside observer at such a congress is that of separating the serious contributor to the science of astronautics from the lunatic fringe that invariably trims such an organization. There have been earlier parallels in other professional societies such as the American Rocket Society. The early days of powered flight had a large share of the crackpot inventor and he still hangs around the edges today. But the IAF is settling down into a professional mold with somewhat less of the pain and strain that has marred other groups.

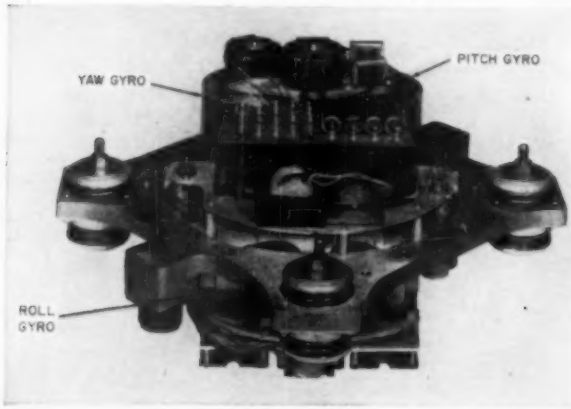
There are still internal problems before the federation and there is one overriding external problem of acceptance in the scientific community; not the tolerant acceptance now tendered

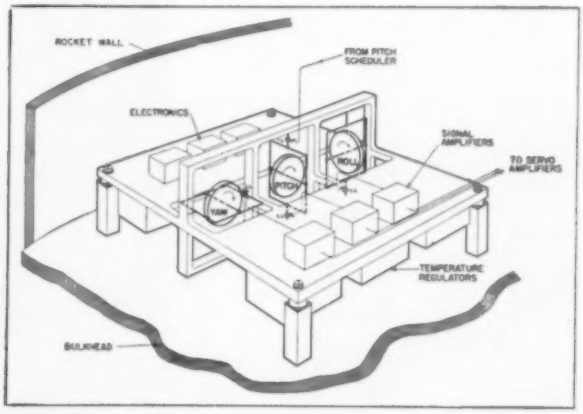
## U. S. Delegates

**U. S. delegates to the IAF Congress included these members of the American Rocket Society: Andrew G. Haley, chief of the delegation; Dr. F. Frenkiel, Johns Hopkins University; Dr. W. B. Lemperer, Douglas Aircraft; J. H. Reinber, Lockheed Aircraft; Krafft A. Ehricke, Convair Division of General Dynamics; Dr. H. R. J. Gosch, General Electric Co.; James W. Mullen, II, Experiment, Inc.; Darrell Romick, Goodyear Aircraft Corp.; Richard Schmidt, Edwards AFB; Dr. S. F. Singer, University of Maryland; David A. Anderton, Aviation Week.**

**Delegate of the American Astronautical Society was Norman V. Petersen, Sperry Gyroscope Co.**

**A large contingent of air research and development officers and scientists, predominantly from the USAF Cambridge Research Center, attended the congress. Among these were: Gens. L. I. Davis and Don Flickinger of Holloman AFB and the ARDC European office.**




## Vanguard Guidance

**Earth satellite inertial guidance element will play key role in establishing orbit. Produced by Minneapolis-Honeywell, it uses three integrating (HIG) gyros to sense roll, pitch or yaw displacement of first and second stage rockets from desired flight attitude. Signals generated by gyros will feed magnetic amplifiers and serve actuators developed by Vickers Electric, which shift position of gimbal-mounted rocket thrust chambers to return rocket to required attitude. Changes in rocket pitch attitude, to bring third-stage and satellite into correct launching position, are programmed and introduced into pitch-axis HIG gyro by small torque motor which precesses gyro to desired rocket pitch attitude. Transistor amplifiers, built on M-H unit, control temperature of HIG gyro damping fluid.**

but complete and sincere cooperation.

The member societies and individuals are intensely serious about their work and particularly emphasize its peaceful aspect. The big excitement this year has been generated by the thought that man's first big jump into space is just around the corner. There is much more than engineering prestige riding on the nose of the Vanguard.

"This is space flight year minus one," said outgoing IAF President Fred Durant. This has been the major theme and greatest excitement of this congress.

## Navy Orders New A3J From North American

**Washington**—Navy last week awarded North American Aviation's Columbus, Ohio, division an $86 million contract for research and development on a two-place, twin-jet "high-supersonic, carrier-based attack aircraft weapon system" designated A3J. Powerplants probably will be General Electric's J79.

The Navy also expressed intent to buy prototype flight and static-test models. First stage of the development contract includes evaluation of the aircraft's navigation-bombing systems, construction of mockups, wind tunnel tests and initial phases of design.

The Navy pointed out that its adoption of the term "weapon system" for the A3J was a departure from past airframe-design approach and is being used "because of the manufacturer's integration of equipment systems."

## Faneuf Replaces Bell As Bell Aircraft Head

**Buffalo, N. Y.**—Lawrence D. Bell, founder of the Bell Aircraft Corp., announced his resignation as president of the firm last week and his elevation to chairman of the board. New president is Leston P. Faneuf.

Faneuf, 52, served as assistant to the president, secretary, secretary-treasurer, general manager, vice president and director since joining Bell in 1942.

Bell, 62, entered aviation in 1912 as a mechanic. Later, he became vice president and general manager for the Glenn L. Martin Co. of Los Angeles. In 1928, he joined Consolidated Aircraft Co. of Buffalo as vice president and general manager. He organized Bell Aircraft in 1935.

In another move, Harvey Gaylord, vice president and general manager of Bell's Helicopter Division at Fort Worth, was elected a director of the parent company. When re-incorporation of the Division into a wholly-owned subsidiary becomes effective later this year, Gaylord is expected to be named president.

# Flight Characteristics of B-58 Simulated with Modified F-94

**Buffalo, N. Y.**—Flight characteristics of Convair's supersonic B-58 Hustler bomber were successfully simulated by Cornell Aeronautical Laboratory, the Air Force and Convair in a modified F-94 fighter before the first B-58 was built.

Cornell is also known to be working on even more versatile applications of this technique.

The B-58 studies were an integral part of a seven-year research program on stability and control, which has been sponsored largely by the Air Research and Development Command's Wright Air Development Center.

### Avoided Costly Changes

Through the use of highly-specialized automatic, mechanical and electronic components, the F-94 was used to determine performance characteristics of both the proposed control system and the B-58's configuration.

Findings were incorporated into the design, avoiding costly changes in the prototype.

The studies were made by Cornell's chief pilot, John C. Seal; B. A. Erickson, manager of flight for the Fort Worth, Tex., plant of Convair Division of General Dynamics Corp. and chief engineering test pilot for the B-58 flight test program, and an Air Force pilot.

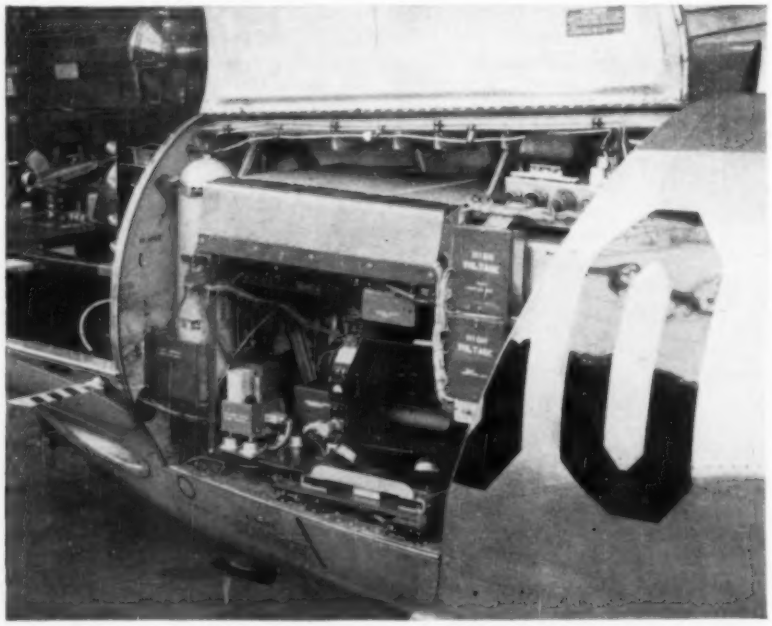
The B-58, which recently was rolled out at the Fort Worth plant (AW Sept. 10, p. 34), is now beginning taxi tests.

Cornell said the B-58 studies were the first direct utilization by the aircraft industry of the laboratory's variable stability techniques.

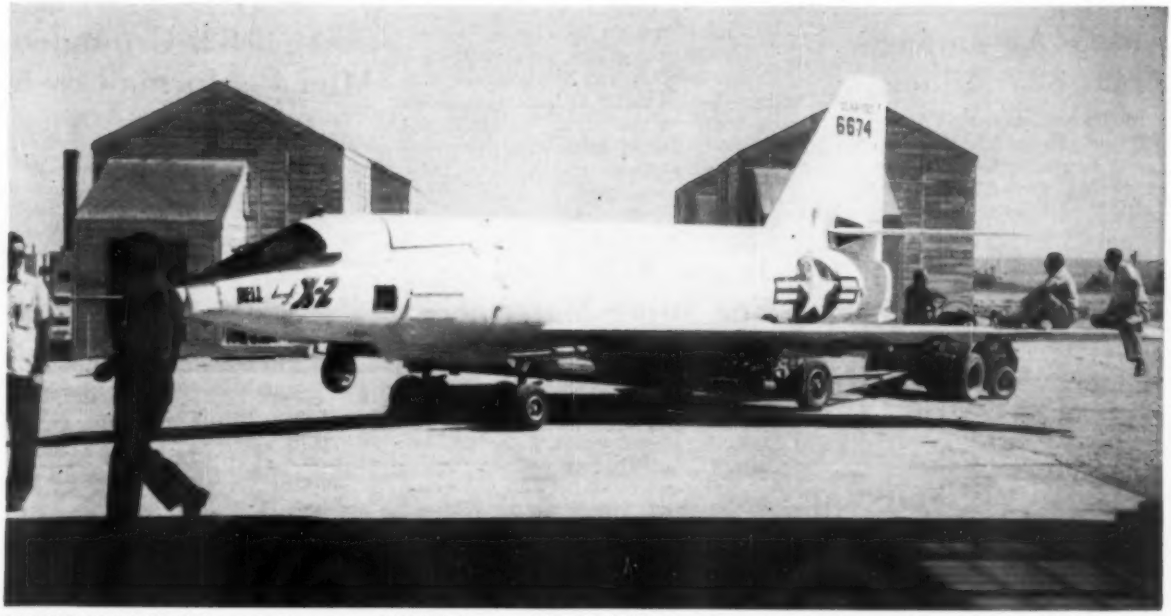
### Cornell First

Cornell first used the technique to modify lateral stability characteristics on an F4U-5. It also has made non-linear servo installations on an F4U-5 and an F-86E; increased yaw damping of an F-86E to improve tactical utility; varied longitudinal characteristics of the F-94 and a B-26. In 1953, Cornell applied three-axis variable stability to a C-45 transport.

In the F-94 used for the B-58 program, the longitudinal control system was actuated by special hydraulic servos that permitted wide variations of stability and control characteristics. Stability was introduced through automatic movements of the control surfaces independent of the pilot's actions. Superimposed on the variable stability equipment was a control system for adjusting the stick force in motion to the amount desired by the pilot for proper control by "feel." Changing control knobs in effect varied the design of the test plane.



**COMPLEX** instrumentation in nose section of Cornell's variable stability F-94. Forward instrument section contains data recording equipment and larger section holds the variable stability electronics equipment. Note small auxiliary surface (far left) attached to side of fuselage.




**ROCKET-POWERED** X-2 was built as part of USAF, Navy and National Advisory Committee for Aeronautics cooperative effort for flight research. Plane and its predecessor, the X-1A, were manufactured by Bell Aircraft Corp. in Buffalo, N. Y.

# X-2 Sets Altitude Record at 126,000 Ft.

**Washington**—Accumulation of flight data from successfully controlled flight at altitudes of up to 126,000 ft. has begun at Edwards AFB, Calif.

Early this month, the Bell X-2 piloted by Capt. Iven Kincheloe, Jr., is known to have reached approximately 126,000 ft., a record for a manned aircraft. Both the USAF and Department of Defense have refused to confirm the record figure.

However, Defense Secretary Charles Wilson admitted late last week that the rocket-powered X-2 had exceeded the previous record of 90,000 ft. established Aug. 26, 1954, in the Bell X-1A by Maj. Arthur Murray.

Late in July, the X-2, then flown by Lt. Col. F. P. Everest established a speed record in excess of 1,900 mph. (AW Aug. 6, p. 454). The design speed of the X-2 is 2,500 mph.

The altitude record is in excess of the 120,000 ft. which the USAF originally hoped the X-2 research plane would be able to attain.

Primary significance of the flight is the successful control of the X-2 at an altitude of nearly 24 mi. "It was so easy," one report said, "every one was amazed."

In addition the collection of other important high-altitude data has begun in earnest.

Unfortunately, later flights since the record run have aborted just prior to the drop from a modified B-50 mother plane.

Although the primary purpose of the research aircraft is the accumulation of high altitude and high speed flight data —none of which is revealed in the altitude and speed records—the Pentagon made a strenuous effort last week to prevent publication of the altitude record. It has never officially confirmed the speed record.

This effort was directed from a high military level and not from the civilian aides usually held responsible for withholding information. The decision apparently had the backing of the White House.

For more than a week, press and Pentagon public relations officers attempted to convince top military officials that the facts were too widely known to be kept secret.

Nevertheless, by the time Secretary Wilson held his press conference, the decision had not been changed.

The X-2 is powered by a 15,000-lb. thrust, double-barreled Curtiss-Wright rocket engine.

In its speed run in July, the X-2 did not reach its design speed of 2,500 mph. because of heat problems with the turbo-fuel pump.

The ease with which the X-2 passed its 120,000 ft. target indicates that on this flight there were no deficiencies.

**BELL** X-2, powered by 15,000-lb. thrust Curtiss-Wright double-barreled rocket engine, now holds both altitude and speed records—126,000 ft. and 1,900 mph.

## Aussie Air Imports Total $23 Million

**Melbourne, Australia**—Australian imports of aircraft, aircraft parts and engines, covering the fiscal year ended June 30th, totaled $22,935,593.

Value of aircraft imported, including helicopters, gliders and airships, was $7,797,673. Of this amount, imports originating in the United States were worth $1,553,254.

Imports of 226 aircraft combustion engines, including jet, were worth $5,577,600.

Imports of aircraft parts were worth $9,560,320. Of these, 60% originated in the United States.

## B-47s to Fly Non-Stop From U.S. to Australia

**Washington**—Three Strategic Air Force B-47s are scheduled to make the first non-stop flight from the U.S. to Australia in November during the third annual Operation Handclasp. They also will visit New Zealand.

They will time their arrival with the Olympic Games at Melbourne and coincide their flight with six RF-84F Thunderflash jets from the Far East Air Force's 67th Tactical Reconnaissance Wing at Itami, Japan, and a C-124 Globemaster and three C-119 Packets from the 315 Air Division at Tachikawa Air Base, Japan. The 15th AF B-47s will refuel in flight from KC-97 tankers.

Handclasp reaffirms the close ties between the U.S. and Australia and their air forces. The USAF planes, as guests of the Royal Australian Air Force, will fly over 13 cities in Australia, New Zealand and Tasmania and will be on static display at four cities in Australia and one in New Zealand.

## Irvine Asks Industry For Super Materials

**Los Angeles**—Lt. Gen. C. S. Irvine, Air Force deputy chief of staff for materiel, last week called for "dramatic, revolutionary developments" in aircraft materials to prevent the U.S. from losing its qualitative superiority in the air.

"We must come up with something revolutionary, something that changes our entire thinking in regard to the use of materials in air vehicles," Gen. Irvine told a meeting of the American Society for Testing Materials here. "We need," he said, "major breakthroughs all along the line."

Gen. Irvine urged "independently sponsored research and development programs," investigation of the "terrific possibilities" of plastics and ceramics, and abandonment of the "easy way out" in the search for alloys and new metals. He added:

"In just a few years . . . our intercontinental bomber missiles may be viewing speeds of Mach 20 . . . with temperatures in the area of 10,000F."

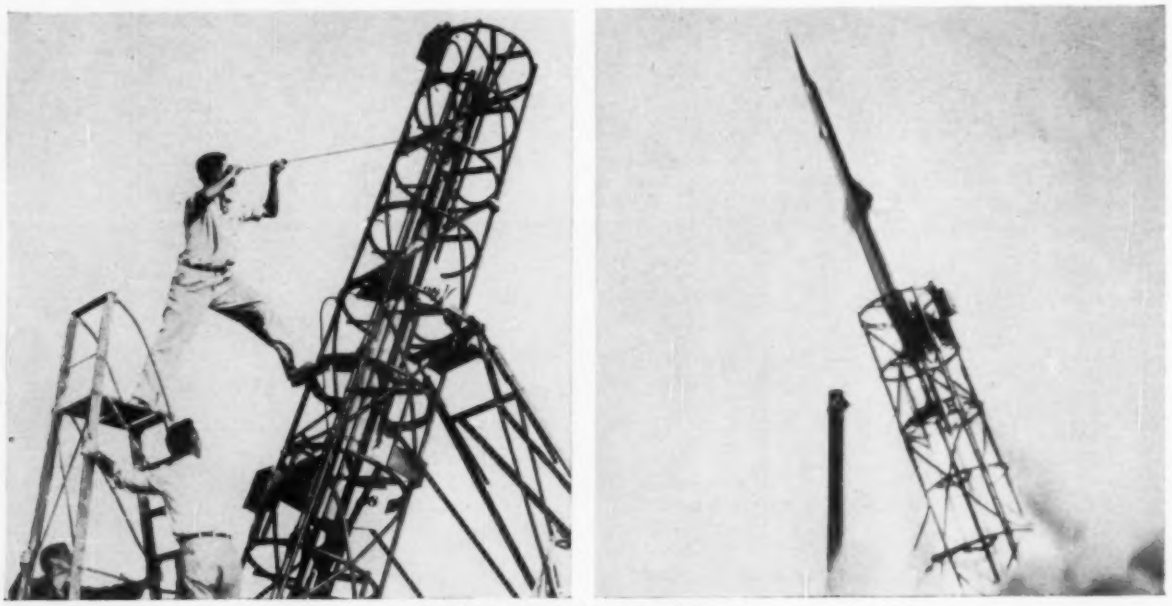
## USAF B-52s Grounded After California Crash

**Wright-Patterson AFB, Ohio**—Air Materiel Command last week ordered the grounding of Strategic Air Command's Boeing B-52 intercontinental bombers as a "precautionary measure" after a Stratofortress caught fire and crashed near Castle AFB, Merced, Calif., killing five crew members. The pilot and copilot ejected and escaped with superficial burns.

Despite the grounding, flights were being readied daily and crews remained on a standby basis in the event of an emergency. The B-52s were grounded temporarily last February until a type of alternator which had caused the crash of another Castle AFB bomber was modified.

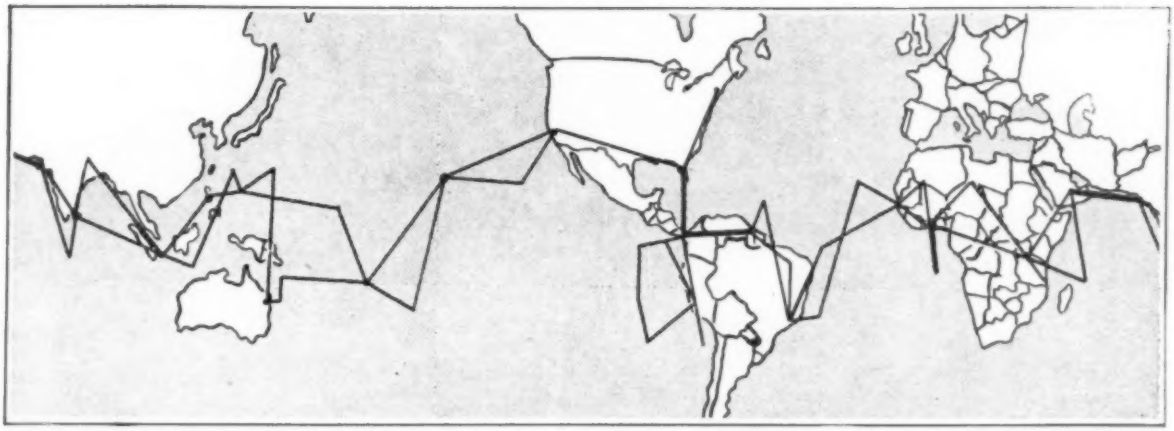
The aircraft commander, in last week's crash, Maj. Benjamin R. Ostlind, 4017 Combat Crew Training Squadron, and copilot, Capt. William J. Vetter, 93rd Bombardment Wing, said they were returning to Castle on a training flight when their compartment filled with blue smoke.

Maj. Ostlind opened the escape hatch and fire filled the compartment, burning his hands and neck. He gave orders for the crew to leave the aircraft, and he and Capt. Vetter ejected. He said he looked back as he parachuted down and saw the B-52 enveloped in flame. It exploded on impact, destroying a farm house.



**Hypersonic Rocket**

Wright Air Development Center's Hypersonic Test Vehicle (HTV) spews flame and smoke as it is fired from 16-ft. launcher. Technicians (left) prepare vehicle for firing. Rocket was developed by USAF and Aerophysics Development Corp., a Curtiss-Wright subsidiary. Fifteen experimental models already have been fired and tested at Holloman Air Development Center, and design is nearing standardization. HTV is two-stage, ten feet long, fired from portable launcher. It reaches 5,000 mph. within two seconds of launching.



**ROUTE** of globe-circling KC-97 tanker provided by SAC which will airlift a cosmic ray monitor seeking to determine the shape of the earth's magnetic field. Plane will carry scientists from ARDC's Cambridge Research Center on 90,000-mi. journey.

# Air Force to Map Earth's Magnetic Field

By Evert Clark

**Bedford, Mass.**—Air Force scientists last week began an ambitious three-month, 90,000-mi. flight to map the earth's magnetic field more accurately.

A KC-97 Stratofreighter carrying a 1,500-lb. cosmic ray meter took off from L. G. Hanscom Field here on a flight that will range 900 nautical miles on either side of the earth's equator measuring cosmic ray intensity at a constant altitude of about 18,000 ft.

The project, called "Tan Glove," is sponsored by Air Research and Development Command through its Cambridge Research Center here, the Strategic Air Command and the University of Chicago.

Studies by Dr. John A. Simpson, physics' professor, and Peter Meyer, assistant professor of physics, at Chicago University's Enrico Fermi Institute for Nuclear Studies, have indicated that the pattern of the magnetic field far out in space is not the same as it is at the earth's surface. The effects of the outer field on incoming cosmic radiation should give a fairly accurate indication of the pattern.

Dr. Simpson and Mr. Meyer developed the measuring techniques being used and proposed the flight. Essentially, the cosmic ray monitor is a neutron pile adapted to measure neutrons and protons locally produced by incoming radiation.

Project scientist is Ludwig Katz, head of the Geomagnetics Section of Cambridge's Geophysics Research Directorate. He will do most of his traveling in a SAC C-124 Globemaster which is leap-frogging ahead of the KC-97, carrying equipment, supplies and an extra crew for the KC-97.

John F. Butler, an electronics scientist in the Geomagnetics Section, will make most of the flights in the KC-97. He recently spent three weeks flying in an RB-47 equipped with the same cosmic ray monitor, taking intensity readings over the United States. The meter is similar to a network of measuring devices which the Fermi Institute has established throughout North and South America. It was especially adapted for in-flight use.

The scientists hope to locate the geomagnetic equator precisely and determine its relationship to the geographic equator. In addition to increasing understanding of the outer magnetic field, the flights should produce information helpful in planning satellite launchings and other plans for the International Geophysical Year.

## U-2 Crash

**A Lockheed U-2 high-altitude research plane operated by the National Advisory Committee for Aeronautics crashed and burned last week near Kaiserlautern, Germany, killing its civilian pilot, Howard Carey, of Arcadia, Ind.**

**Carey, 33, was a Lockheed employe on loan to the NACA, which is using the subsonic U-2 to collect data in the U. S. and abroad concerning cosmic rays and the concentration of elements that appear in the atmosphere, including ozone and water vapor (AW July 16, p. 28).**

**The U-2, powered by a Pratt & Whitney J57 turbojet, also is probably being used to probe atomic fallouts.**

# India Orders 25 Folland Gnats

**London**—Indian government has placed an $8.4 million order for an initial quantity of 25 Folland Gnat lightweight transonic fighters, breaking a bottleneck that threatened to relegate this design to obscurity, buried beneath official indifference and red tape.

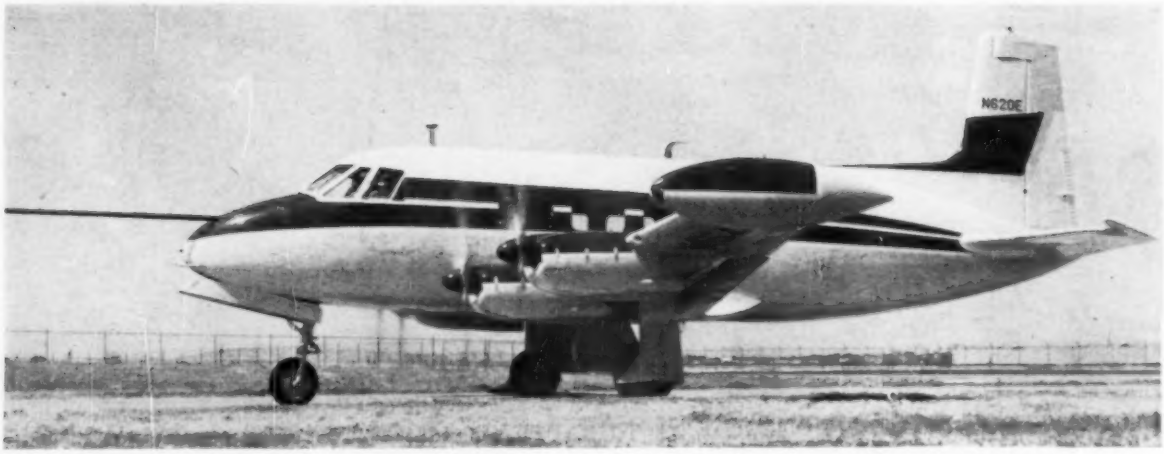
The Indian order had been hanging fire all summer since an initial agreement between the government and Folland was reached on the Gnat order. The Indians failure to sign a firm contract led to considerable speculation that Russian sales efforts to peddle MiG fighters had disrupted the Gnat deal.

The Gnat contract, signed by Mrs. V. P. Paudit, Indian High Commissioner, calls for an initial production of 25 Gnats, with rights to continue production in India under license.

In addition to the Indian order, Folland has a contract from the British Ministry of Supply for six Gnats, of which the first two are now completed, and is placing great hopes on a new transonic trainer development of the Gnat design for a firm Roval Air Force order (AW Sept. 17, p. 23).

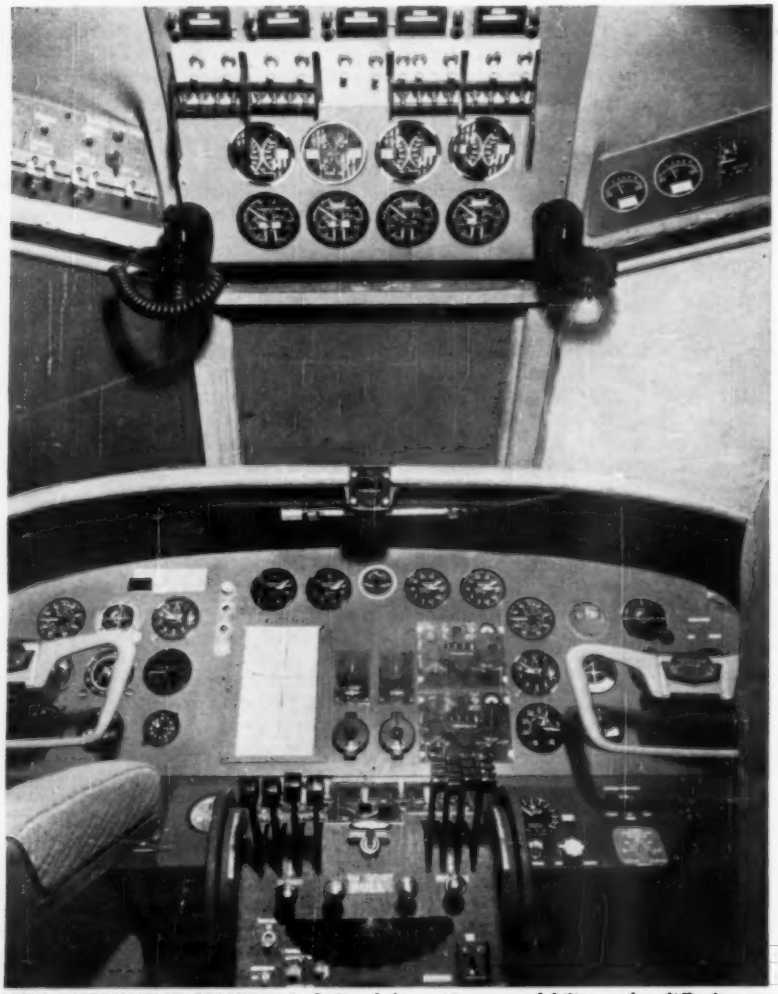
Several other foreign countries are extremely interested in the Gnat but have held off commitments until the ice was broken with an initial order large enough to insure a reasonable price for follow-on production.

Meanwhile, authoritative sources in London say the Russians have offered the Indians the Badger twin-jet medium bomber in a follow-through sales campaign on the heels of the Ilyushin civil airliners pushed into India by the Russians since the Bulganin-Khrushchev visit.



**CESSNA 620 BUSINESSLINER** taxies out for takeoff from McConnell AFB, Wichita. Plane has about 20 hr. flight time.

# Cessna Unveils Model 620 Transport



**NEW INSTRUMENT CONCEPT** is designed for optimum readability under difficult conditions. Radio, navigation controls are on right of approach plan; flight dials to the left in front of wheel. Each engine can be completely secured by flipping one lever (top).

By Erwin J. Bulban

**Wichita**—Cessna Aircraft Co. will begin producing its new four-engine pressurized 280-mph. Model 620 business plane early in 1958. Deliveries will begin late in 1958 at a price of $375,000. The company formally opened its sales campaign on the 9 to 11 passenger executive transport with an open house last Thursday and Friday attended by corporation executives and pilots who watched the airplane fly and were shown mockup of a plush cabin.

Marketing Manager Frank Martin gave the guests new performance figures on the Model 620 that were substantially improved over earlier fragmentary data released by the company:

- **Top speed** of 282 mph. at 15,000 ft.
- **Maximum cruise speed** of 260 mph. at 2,600 rpm. at 12,500 ft.
- **Takeoff over a 50-ft. obstacle** at 15,000-lb.-gross-weight at sea level with one engine out at $V_1$ takes 3,750 ft.
- **Landing distance** at landing gross weight of 14,285 lb. over a 50-ft obstacle at sea level is 3,050 ft.
- **Maximum rate of climb** at 15,000-lb. at sea level is 1,150 fpm.; at 13,000 lb. the 620 will climb 1,520 fpm.
- **Maximum range** at 15,000 ft. at optimum power is 1,700 mi.; endurance at 55% power is nine hours. Fuel capacity is 535 gal.
- **Four-engine operational ceiling** is 25,000 ft.; on three engines and at 14,500 lb., the airplane has a service ceiling of 20,000 ft.

### Figures Are 'Conservative'

The 620 weighs 10,000 lb. empty, this includes provision for 275 lb. of electronic equipment.

Performance figures are given by Cessna as "estimates," but sources close

to the manufacturer say that they are on the conservative side. The company will hold up on definitive data until flight tests are completed and then provide guaranteed figures.

Powerplants are four Continental GSO526-A, six-cylinder horizontally opposed supercharged and geared wet-sump types with exhaust augmentors rated at 350 hp. each on takeoff at 3,200 rpm. at sea level with maximum continuous rating of 310 hp. Critical altitude for METO power is 15,000 ft. at 3,000 rpm. Three-blade constant-speed feathering Hartzell propellers of 93 in. diameter are fitted. Reversible pitch Hartzells are offered as optional equipment.

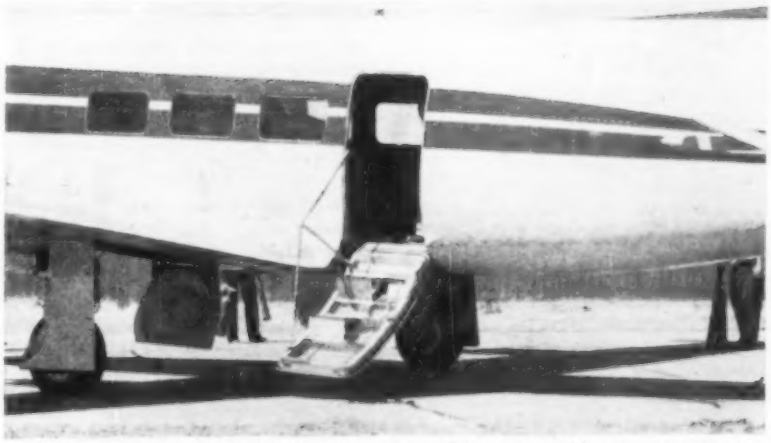
The $375,000 price includes a standard interior of five sleeper-type seats and a folding table. Cessna will provide buyers with a catalog of interior furnishings.

Customers will be credited for standard items not used.

Wing de-icing system and boots, which are of the Goodrich fast-acting high-pressure pneumatic type, and passenger oxygen are extra. Optional equipment includes nonskid brakes, nosewheel power steering, a Collins integrated flight system and a transponder.

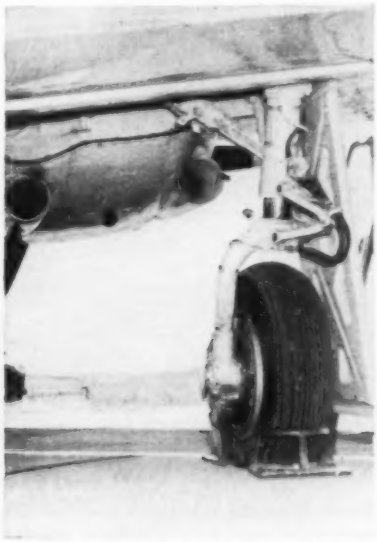
### Pyramid Concept

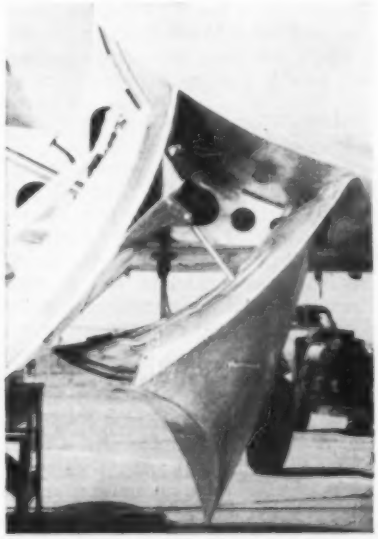
The Model 620 falls into the pinnacle of what Cessna describes as its "pyramid concept" of the corporate airplane market. At the broad bottom of this pyramid lies the deep base of tens of thousands of single-engine light planes; at the next level are thousands of light twins. At the top of this narrowing pyramid is a smaller fleet of heavy types beginning with the Beech 18 and DH Dove through the Lodestar, DC-3, Con-



**AIRSTAIR DOOR** leading into six-foot-high cabin will have retractable steps to save space.

**FLAT CONTINENTAL ENGINES** are especially designed to allow easy check of accessories.





**NOSE AND MAIN LANDING GEARS** (left and center) are designed and built by Cessna. They have Goodyear 125-psi. tires derated to 65-70 psi. Anti-skid brakes are optional, as is power nose wheel steering. Fairing (right) retracts when airstair door is closed.

vair-Liner and as well as some DC-6s.

Until now, Cessna has been broadly represented in the lower layers of the pyramid, and the 620 represents its efforts to cover the entire business plane field by entering the top wedge of heavier, global-type aircraft.

Sources close to the company say that it will offer the Model 620 to the military services for use as an official transport and as a multi-engine trainer for navigation, radar and bombardier crewmen. Several foreign airlines have indicated interest in combination passenger/cargo versions for feederline operations.

The Model 620's specially designed AiResearch gas turbine will provide crew and passengers and baggage and rest room compartment with the equivalent of 8,000 ft. altitude when the airplane is at 18,000 ft. The unit also will completely air condition the airplane on the ground or in the air; provides a source of electrical power to make the 620 independent of external power sources, by driving a D.C. generator. The airplane has 24-V. 50 amp. generator on each engine and on the turbine.

## News Digest

**Lockheed Aircraft Corp.** received a $20 million order for production of T-33 jet trainers on a fixed price contract. The order represented the largest single T-33 purchase in the past three years. It will bring the total number of T-33s to nearly 5,500, will extend production of the trainers into mid-1958.

**Navy ordered** approximately $200 million more of Chance Vought F8U-1 Crusaders from Fiscal 1957 funds. Powered by Pratt & Whitney J57 turbojets, Crusader has been in quantity production since September 1955.

**Martin Co.** will build a new plant, presumably for missile research and development, on a 10-square-mile site recently purchased in the vicinity of Patrick AFB, USAF Missile Test Center near Olando, Fla. Martin already is scheduled to test and launch the multistage Vanguard satellite missile from Patrick. Its Matador tactical missile also was tested out at the center.

**Nine million dollar** contract for overhaul of Lockheed T-33s and F-80 jet aircraft was awarded Aircraft Engineering & Maintenance Co. by USAF. AEMCO, subsidiary of Transocean Corp. of California, announced expansion program nearly doubling size of plant in Oakland.

**General Aviation** Facilities Planning Group retained management consulting firm of Booz, Allen and Hamilton to determine facilities requirements of General Aviation during next 20 years. Study will involve analysis of volume, scope of 70,000 general utility aircraft in U.S.

**American Broadcasting-Paramount Theatres, Inc.,** and Western Union Telegraph Co. purchased 50% interest in Wind Tunnel Instrument Co., Inc., of Newton, Mass. Each of two companies will receive 33,950 shares of Wind Tunnel stock under terms of transaction that involves a total of $400,000.

**Conversion** of Far East Air Force to North American F-100 Super Sabres will begin in November when the first flight arrives for Fifth Air Force's 80th Fighter-Bomber Squadron at Itazuke, Japan. The F-100s will be the first century series fighters to reach the Far East in strength.

**Ryan Aeronautical Co.** earned $33,023,043 for nine months ending July 31. Net profit of company after taxes—$912,999, equal to $2.44 per share.

**Grounded Sea Venom** fighters of Australian aircraft carrier Melbourne resumed flying exercises off New South Wales Coast, still under close watch regarding performance and safety.

**Hunting Associates Percival Jet Provost** is in Canada for demonstration with the RCAF after successful evaluation trials with the RAF.

**United Aircraft Products, Inc.,** of Dayton received first in a series of contracts which will total approximately $5 million for its deaerating cold weather oil system and hot fuel priming system for the Boeing KC-97.

**Hycon Aerial Surveys** of Pasadena, Calif., and the Peruvian Air Force Mapping Agency signed an agreement providing combined facilities for Peruvian companies desiring various aerial geophysical or mapping surveys in that country.

**KC-135 follow-on** orders have gone to Ryan Aeronautical Co. for $12 million worth of fuselage sections and to Lear Inc., Grand Rapids Division, for automatic flight control systems to cost $1,692,641. Ryan also has 707 jet liner fuselage sections contract from Boeing.

**On Mark Engineering Co.,** Glendale, Calif., has been licensed to manufacture and sell spare parts for Douglas B-26 aircraft. On Mark specializes in adapting B-26 bombers for civilian use.

**Transocean Corp.,** of California, holding company for a group of enterprises known as Transocean Air Lines until a reorganization earlier this year, reports a net profit of $433,107 after taxes for the fiscal year ended May 31, 1956 with a gross revenue of $22,378,728 for the period, highest in the company's 10-year history. Transocean's earnings amounted to $1.08 a share.

**Continental Air Lines** with record August passengers revenues of $1.5 million, declared a dividend of 12½ cents a share payable Sept. 30. The August revenue figure was 16% higher than that for August 1955, and topped Continental's previous monthly high of $1,328,000 in October 1955.

**Whirlwind Landing**

**British Westland Whirlwind equipped with pontoons makes an engine-off landing during registration board trials at Calshot. Inflated to a maximum working pressure of 1½ lb./sq. in., pontoons will withstand a test pressure of 12 lb./sq. in. A steel skid about 1½ in. in diameter is fitted onto base of each pontoon to provide protection for terra firma landing.**

# a New 400 CYCLE MOTOR

**with integral gear box for use in missiles and jet aircraft**

EEMCo

technical bulletin

**EEMCO Type D-899** is a compact, light weight 400 cycle, 3-phase motor with an integral gear box that operates on 200 volt power. It was designed by EEMCO especially for use in supersonic aircraft and missiles and meets MIL-M-7969-(ASG) specifications. Weighing only 11.25 pounds, it has a continuous output of 2.75 HP at 3140 RPM at the gear box. The power factor is 83% while the overall efficiency of the unit is 76%. Mounting flange is made to Spec. AND-20,000.

A feature in the design of **EEMCO Type D-899** is that the gear box acts as the motor support which places the base at approximately the center of gravity of the motor-pump assembly. This enables the unit to withstand the extreme shocks and vibrations encountered in supersonic aircraft and missiles. With minor alterations, the motor can be made splash- and drip-proof.

**Type D-899** is another example of the fine craftsmanship found in all EEMCO products. EEMCO's entire effort is confined to the design and production of linear and rotary actuators and special motors of high-output light-weight ratio. Many of the latest jet aircraft and missiles being developed or delivered carry EEMCO units. EEMCO products are also used for industrial applications where precise control tolerances are imperative.

**SPECIFICATIONS OF EEMCO TYPE D-899 MOTOR**

**Model:** 200 volt, 400 cycle, 3-phase.
**Load:** 2.75 HP continuous output.
**R.P.M.:** 3140 RPM output at gear box.
**Power Factor:** 83%
**Overall Efficiency:** 76% for entire unit.
**Military Specification:** Meets MIL-M-7969-(ASG).
**Weight:** 11.25 pounds.
**Comments:** Type D-899 may be made splash- and drip-proof with minor alterations.

**Designers and producers of motors, linear and rotary actuators... exclusively**

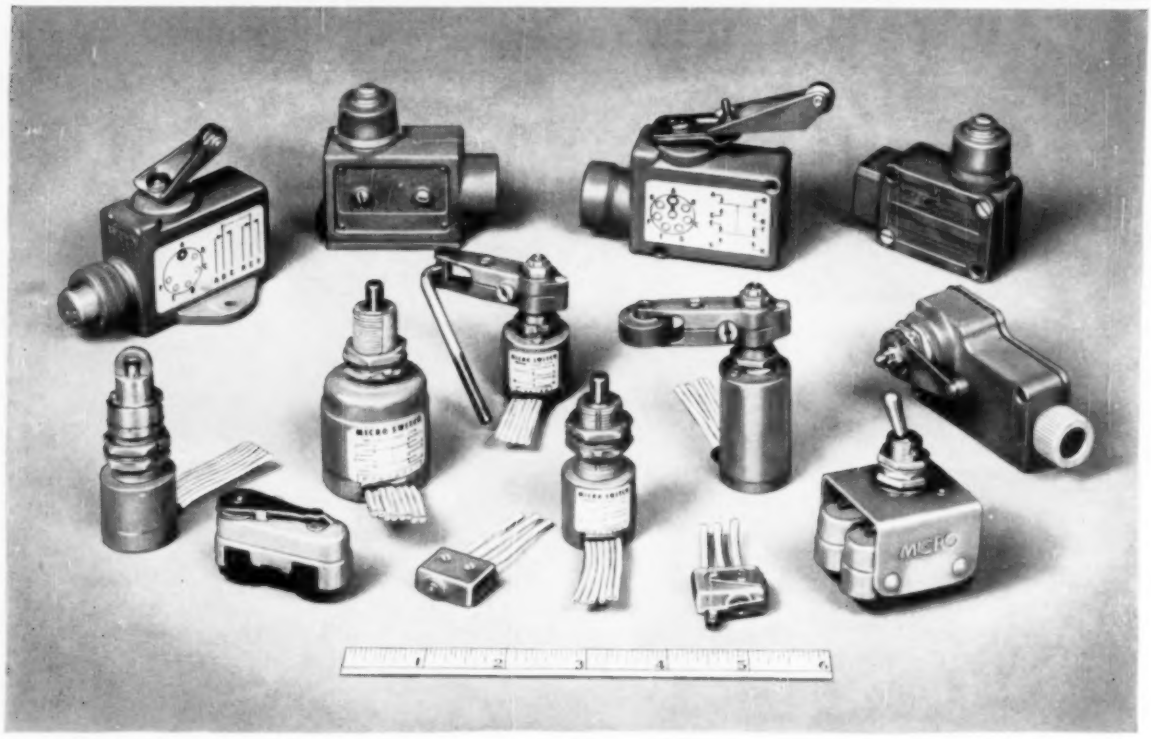
## Electrical Engineering and Manufacturing Corp.

4612 West Jefferson Boulevard
Los Angeles 16, California
Telephone: REpublic 3-0151

3-843

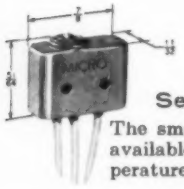
# MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN



## The ever critical aircraft switch problems of weight...space...altitudes...temperatures are continuously met by MICRO SWITCH Engineering

**Cylindrical environment-free switch:**
A compact, completely sealed switch for use on landing gears, flaps or other exposed locations.




**Sealed subminiature switch:**
The smallest lightweight switch of this type available. Gives trouble-free operation in temperatures between −65°F and +180°F.

Selection of the proper switch to meet any aircraft application is simplified by the wide variety of MICRO SWITCH types, shapes, sizes, actuators and electrical characteristics.

Whether your switch must be housed in a protective metal enclosure or sealed hermetically, whether it must control single or multiple circuits —if your design requires a precision switch of extreme reliability, small size and light weight, call MICRO SWITCH.

Illustrated are but a few of the hundreds of the precision switch types MICRO SWITCH Engineering has developed to meet aircraft design requirements. All are ruggedly housed or sealed against environmental changes and exposures. It pays to bring your switch problems to MICRO SWITCH.

***For complete information on the complete line of aviation switches contact the MICRO SWITCH branch office near you.***

# MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

*In Canada, Leaside, Toronto 17, Ontario* • FREEPORT, ILLINOIS

# Collins 'Radar Cocoon' to Protect Aircraft

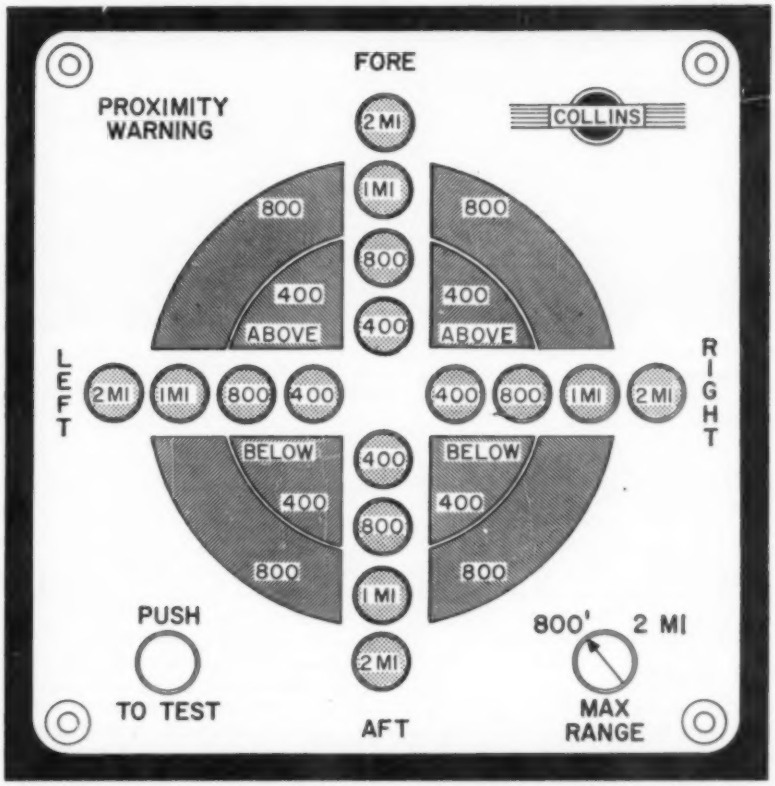
By Philip J. Klass

Development of a self-contained airborne proximity warning system, which in effect erects a protective radar cocoon around an airplane as it moves through the sky, will be the first phase of a two-part Collins Radio Co. program aimed at fully automatic air-to-air collision avoidance.

Collins expects to begin flight tests on a prototype proximity warning system (Phase I) in January 1958, and hopes to start production by September of that year.

If another airplane penetrates this radar cocoon, the proximity warning system will flash a warning to the pilot of the equipped airplane and a panel indicator will show the approximate bearing and distance to the intruding aircraft. During VFR weather, the pilot can then look for the intruder, decide whether he presents a collision threat requiring evasive action. In IFR weather the pilot will have to make the decision solely on the basis of bearing-distance information on his indicator.

In the second phase of the program, Collins will develop a collision avoidance computer which, when added to the proximity warning system, automatically will determine whether the intruding aircraft represents a collision threat. If it does, the computer will indicate which direction the pilot must turn to avoid the threat.




**COLLINS** airborne proximity warning system indicator shows range of intruding aircraft and relative location at own-ship altitude. Pie-shaped sectors light up to show presence of aircraft directly above or below own airplane.

## How It Works

Design of a computer to determine automatically whether a collision threat exists is considerably more complex than the proximity warning task. Research and analytical studies into collision problem dynamics will be carried out by Collins concurrently with the development and design of the proximity warning system. Barring unforeseen difficulties, Collins hopes to have initial quantities of the collision avoidance computer available by November 1959.

Depending upon the quantity of proximity warning systems ordered by the airlines and business aircraft operators, the system will cost the airlines around $6-7,000. The collision avoidance computer will cost perhaps another $3-5,000, according to present estimates.

The proximity warning system is expected to weigh about 55 lb. and occupy a one-ATR size case, exclusive of antennas and panel indicators.

Heart of the Collins system is a frequency modulated (FM) continuous-wave (CW) S-band (3,000 mc.) radar. Collins selected FM-CW in preference to pulse-type radar because of its ability to operate at extremely short ranges. The CW output is frequency modulated at 400 cps., in synchronism with the aircraft's 400 cycle a.c. power supply.

Six non-rotating feed horns (antennas) will be employed to provide the following radar beams around the aircraft:

- **Upper hemisphere,** capable of detecting the presence of any airplane within an 800-ft. radius but unaffected by aircraft passing 1,000 ft. above.
- **Lower hemisphere,** providing a similar 800-ft. radius of detection below the aircraft.
- **Line-of-flight,** providing 360 deg. coverage in azimuth, 7½ deg. above and below own-plane altitude, and extending out to a range of two miles. In high density terminal areas, pilot can reduce this line-of-flight azimuth coverage to an 800-ft. range to prevent needless false alarms.

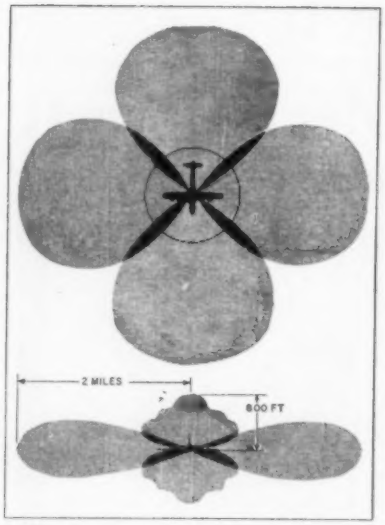
If possible, the five feed horns for generating upper hemisphere and line-of-flight (azimuth) coverage will be mounted atop the vertical stabilizer for optimum radar vision.

## Continuously Excited

The four line-of-flight antenna horns will be arranged so that each covers a different 90-deg. azimuth quadrant (see sketch, p. 38). Each horn will be energized and connected to a radar receiver for one-half second, following which the next quadrant will be energized. The fully 360 deg. azimuth area will thus be covered every two seconds.

The two hemispheric beam antenna horns will be continuously excited and monitored by two independent radar receivers.

A radar echo from an intruding aircraft will serve to detect its presence. The phase shift between the echo and




**MAXIMUM** coverage of protective radar beams is shown in plan view (above) and line-of-flight view (below).

the radar signal being transmitted at the instant the echo returns, due to the 400 cycle FM sweep, can be used to determine the distance to the intruder and his rate of closure. (The latter is required for the collision avoidance computer but is not displayed in the proximity warning indicator.)

### Pilot Warning

When an intruder enters one of the three radar beams, the pilot will get an audible warning plus a visual display of the intruder's approximate position and distance on a 5 x 5½ in. panel indicator (See sketch, p. 37).

For example, if the intruder enters the upper (or lower) hemisphere at a range between 400 and 800 ft., the outer portions of the two upper (or lower) pie-shaped sectors on the indicator will flash on and off. If the intruder is at a distance of less than 400-ft., the inner portions of the two pie-shaped segments will light up.

If the intruder is at or near own-plane altitude, it will first encounter one of the four quandrantal radar beams which surround own-plane in azimuth. Intruder position determines which of the four quandrantal beams is intercepted and this in turn determines which one of four legs on a plan-view quadrant indicator display comes into use to show intruder position.

The proximity warning system measures the distance to the intruder and then displays it in the proper quadrant of the indicator by flashing on and off one of four lights, i.e. "2-mi.," "1-mi.," "800 ft.," or "400 ft."

For example, if another aircraft comes within two miles of the tail of a proximity warning system equipped airplane, the "2-mi." lamp in the tail quadrant of the indicator will start flashing. If neither pilot takes evasive action, the "1-mi." lamp will start to flash on and off when the intruder has closed to within about 6,000 ft.

Pilot can check whether proximity warning system is functioning during flight by pushing a button on panel indicator. This tests transmitter power output, receiver sensitivity, all receiver circuits, and all indicator lamps.

### Multi-Aircraft Capacity

The Collins system has the capacity for handling and warning of more than one intruding aircraft, providing they are in different hemispheres or quadrants. Within any one quadrant, the system can discriminate between two aircraft providing that each is at a different range. For example, in the unlikely event that there were four aircraft in the tail quadrant simultaneously, one at a range of one to two miles, another at a distance of approximately 800 to 6,000 ft., a third between 400 and 800 ft., and a fourth within 400 ft., all four lamps in the tail quadrant of the indicator would be flashing on and off.

The system's ability to accommodate a number of aircraft is an important requirement if the pilot, or the later collision avoidance computer, is to be able to determine what evasive action should be taken, without getting into an even more precarious position.

The ATA-airline decision to go to a self-contained type of proximity warning/collision avoidance system, at the possible expense of increased weight and cost over simpler cooperative type systems, has the important advantage that each aircraft gains immediate protection when it installs the Collins equipment without having to wait for other airspace users to install cooperative equipment.

Although a primary reason for Collins radio's choice of an FM-CW radar for aircraft detection was its ability to operate at extremely short ranges and provide good range, rate-of closure, and rate of change of closure signals, there are significant by-product advantages, an ATA spokesman points out.

The same radar conceivably could be used in combination with a dead reckoning computer to provide a completely automatic self-contained navigator for off-airways flying or to backstop the Vortac system. The FM-CW radar also can provide a direct indication of ground speed, wind drift and absolute altitude (terrain clearance).

The system should function effectively to warn pilots of mountainous terrain at their flight level.

### Private Flyer Protection

The cost and weight of the Collins system makes it unlikely that any small aircraft operators will consider its installation. However, by the addition of an extremely small, low-cost microwave receiver it should be possible for light plane operators to get a warning whenever they enter the radar cocoon of a proximity-warning equipped airplane, a Collins spokesman told AVIATION WEEK. Radar illumination of the small airplane by the equipped aircraft would trigger the device.

The new proximity warning system is the result of more than a year's efforts by the Air Transport Association, which released operational requirements for such a system in the spring of 1955 to spur avionic industry interest and activity (AW April 18, 1955, p. 17).

# ICAO Begins Navigation Review

**Montreal**—More than 20 nations were represented at the third Air Navigation Conference of the International Civil Aviation Organization which began here last week to review problems associated with airworthiness and operation of aircraft over international routes.

The U.S. delegation to the conference was headed by Oscar Bakke, of the Civil Aeronautics Administration, with Robert W. Craig, also of CAA, serving as vice chairman of the group. The conference is expected to continue for between four and five weeks.

Items on the conference agenda include:

- **International airworthiness standards.** Existing detailed airworthiness standards will be replaced by standards broader in scope to cover basic requirements for air safety yet provide for technical advances in aircraft design.
- **Operational control.** A study of the relationship between pilot and ground controllers will be conducted to clarify procedures covering the exercise of authority as to continuation, diversion or termination of international flights.
- **Route familiarization.** Consideration will be given to the amending of present rulings which require pilots to fly international routes on non-passenger flights before taking over command of regularly-scheduled flights. The feeling is that standardized procedures and route information are sufficient to enable pilots to operate passenger-carrying aircraft without previous route experience.
- **Rearward-facing seats.** Suggested use of specially-stressed, rearward-facing seats to reduce danger of passenger injury in case of accident will be discussed.
- **Navigation lights.** Better visual means of avoiding mid-air collisions will be studied.

**MEMBERS** of IATA executive committee during meeting in Caledonia Hotel in Edinburgh. From left to right, reading clockwise: Sir Leonard Issit, K.B.E., Tasman Empire Airways; D. M. Robbertze, South African Airways; Sir Hudson Fysh, Qantas Empire Airways; Croil Hunter, Notthwest Airlines; Lord Douglas, BEA; John Leslie, PAA; Per Norlin, SAS; Gilbert Perier, Sabena; Gordon R. McGregor, TCA; Dr. Walter Berchtold, Swissair; F. von Balluseck, KLM; A. J. Quin Harkin, manager IATA clearing house, London; Dr. H. J. Gorecki, treasurer & financial director, IATA; F. J. H. Johnston, assistant treasurer IATA, Warren Lee Pierson, TWA; A. Laurence Young, secretary IATA; Sir William P. Hildred, Director General IATA; Major J. R. McCrindle, BOAC; Prof. John C. Cooper, legal adviser IATA; J. W. S. Brancker, traffic director IATA; Col. Luis Calderon, Linea Aeropostal Venezolana; M. Rene Briend, Air France; J. R. D. Tata, Air India. Tata is nearest camera at left, with hand on face.

# Jet Age Planning Dominates IATA Meet

By Robert Hotz

**Edinburgh**—Technical problems posed by the approaching jet age engrossed the 12th annual general meeting of the International Air Transport Assn. here last week as top-level management joined operations technicians in a concerted drive to produce the proper technical environment for gas-turbine transports before 1960.

Lord Douglas of Kirtleside, British European Airways chairman and new IATA president, called for the development of a "fully positive system of control for all aircraft, including military operations in civil airways" and warned: "We will have to abandon altogether the visual method of avoidance and rely entirely on control methods which will apply at all times regardless of weather."

Lord Douglas' statement was the strongest yet made by top-level airline management for positive traffic control and abandonment of the "see and be seen" philosophy that has produced air collisions such as the United Air Lines-TWA tragedy over the Grand Canyon on June 30.

### Collision: Who's to Blame?

Lord Douglas noted that the airline industry was deeply perturbed by the number of air collisions and near misses that have occurred recently. He added:

"In many of these cases, the investigation discloses that neither pilot was to blame, but one is obliged to admit that this is a rather sinister conclusion because, in those many cases where pilots were not to blame, the corollary is clearly that the rules or procedures must be to blame.

"It is a matter of urgency that the rules and procedures should be reviewed to reduce the present danger of mid-air collisions."

One of the main features of the European aspect of this problem is the uncontrolled instrument flying by military aircraft on civil airways. Two recent incidents highlighting this problem involved a collision between a Royal Air Force Anson trainer and a Viscount airliner plus a near miss between RAF Vampire jet fighter and a passenger-loaded Viscount.

Evasive maneuvers required by the Viscount pilot to avoid the Vampire were so violent that close ground inspection was necessary to determine if there had been any structural damage.

### Invitation to Aeroflot

In retiring after a year as IATA president, Juan Trippe, Pan American Airways president, told the meeting:

"No informed person can question the fact that improvement of air navigation plus traffic control facilities are vital if the constantly growing demand for airline services is to be met with the maximum advantage to the public and if the great jet transport fleet which is just around the corner is to develop its full potential."

Trippe also repeated his last year's invitation to Aeroflot, Russia's state-owned airline, to join IATA as evidence of the Soviet Union's sincerity in dissolving the Iron Curtain and promoting world peace.

There were no Aeroflot observers present, but Russia was informally represented by Col. Anton Konstantinov, air attache in Britain, who was invited as an observer by Lord Douglas and lunched informally with Douglas, Trippe and Sir William Hildred, IATA director general.

Public support from these airline presidents bolstered the report of the IATA technical committee headed by Anselme Vernieuwe, executive vice president of Sabena Belgian World Airlines. The IATA technical committee was concerned with two basic phases of the traffic-control problem:

- **Improvements in present system** to enable safe handling of the maximum traffic loads possible during the next five years.
- **Development of new systems** plus principles to meet the demand of the first large-scale jet operations from 1961 onward.

The technical committee recommended an eight-point program for immediate improvements in air traffic control:

- **Standardization and speedup** of

**SIR William P. Hildred, Director General of IATA; Juan T. Trippe, president of PAA and retiring IATA president; and Lord Douglas, BEA chairman and new IATA president.**

pilot position reporting procedures.

• **Early development of internationally** accepted and compatible system of secondary radar.

• **Reduced longitudinal** separation minima and position reporting in areas where navigation facilities permit.

• **Regulation of all** aircraft movements by air traffic control systems at all times in congested areas.

• **Anti-collision lights** on all craft.

• **Strict rules that no aircraft** be permitted to get closer than 500 ft. to another for military identification or any other purpose.

• **Development of altimeters** that can provide accurate measurements at high altitudes.

• **Make a detailed study** of weather, maneuvers and holding patterns for current equipment applicable to jets.

The technical committee also called for a basic reorganization of traffic control methods on an area, rather than a route, basis and for an end to nationalistic political boundaries for control areas. Such boundaries, it said, have been made unrealistic by present aircraft speeds.

Looking to future traffic control system requirements, the committee noted that "the increasing speed and density of traffic will require a spectacular increase in the speed of communications and an increasing measure of discipline on the part of pilots and operators." The committee warned that the increase in North Atlantic traffic is posing serious control problems by fast saturating the available airspace. "No radical improvements can be expected until navigation aids of greater range plus reliability are devised and installed or until present air-to-ground and point-to-point communications are improved.

"Before this we cannot anticipate any significant reduction in the large protective boxes of airspace around each transatlantic aircraft. We must therefore rely on other measures such as improving existing facilities, streamlining procedures and exploiting all known communications techniques."

Other committee report subjects:

• **Single sideband high frequency** communication technique was recommended as an international standard to fit the growing volume of air-to-ground radio traffic into the limited frequency spectrum available.

• **New system of runway lights** for instrument landing runways was recommended by IATA to the International Civil Aviation Organization. This runway light configuration uses narrow gauge, double bands of flush lights from the runway threshold extending 3,000 ft. down the centerline at 75-ft. intervals. Supplementing these lights down the centerline of the runway are broad, double row elevated lights running the length of runway in the same position ordinary runway lights now occupy.

• **Runways required** for jet transport operations will not pose as serious construction problems as anticipated earlier. The committee noted that, over the present route pattern, big jet transports will take off at full gross weight from only a few major international terminals. Most airports will not require special new runways for jet operations. Rather than lengthening existing runways in anticipation of jet operations, the committee recommended the construction of stopways—cleared areas beyond the end of the runway where jet transports can be stopped after abortive takeoffs. These will require much less expensive construction than runways.

Runways and taxi strips whose weight capacities are satisfactory for present heavy aircraft also will be able to handle jets because of the load distribution of four wheel, dual tandem landing gear and satisfactory cross wind landing characteristics, the committee noted.

• **New inspection techniques** will be required if airlines are to utilize properly the new fail-safe design philosophy being incorporated into gas turbine transports. The committee said that, unless the airlines devise more thorough methods for detecting early and harmless structural failures generated by the fail-safe design, they will be unable to take advantage of its virtues. It recommended more efficient application of current inspection techniques and thorough exploration of ultrasonics and radiography as promising solutions.

## Fare Adjustment Necessary

**Edinburgh—It is evident from the 12th annual general meeting of the International Air Transport Assn. that basic changes in the international airline fare structure are a necessary preliminary to the successful opening of the jet air transport age.**

**Indicative of the emergency is the three-tier fare structure with an absolute minimum fare which offers slower, no-frills-type air transportation.**

**K. G. Granville, commercial director of British Overseas Airways Corp., who presided over IATA's Cannes traffic conference last June, noted that the three-tier fare structure is already operating in the Middle East and will soon be extended to the North Atlantic.**

**Granville warned that many problems touched on by the Cannes conference will become acute by the time the conference meets again next September. He said:**

**"Unless we are able to find solutions to these problems, we may find ourselves so over-complicating the task of our sales offices that, though we have the right fares and rates, nobody can explain them to the passengers."**

**Lord Douglas of Kirtleside, chairman of British European Airways, pleaded for less secrecy about future sales plans of competing airlines as necessary for the organization of a new rate structure for the jet age. "There is," he said, "something rather incongruous about the fact that technicians of industry have already started a series of meetings to discuss frankly and openly the operational problems of the jet age, whereas our worries about commercial problems of the jet era have only been mentioned privately in dark corners.**

**"Are we not oversensitive about the competitive importance of keeping secret our future commercial plans? Would we not do better to put all our cards on the table instead of continuing to hold our commercial cards so closely that we can hardly see them ourselves?"**

## Reduction Planned In Reserve Air Fleet

**Washington**—The number of airliners allocated to the Civil Reserve Air Fleet will be reduced during Fiscal 1959, according to Thomas Hardeen, Jr., administrator of the Defense Air Transportation Administration.

The revised allocation, based upon recommendations by the Industry Allocations Advisory Committee, calls for 351 four-engine transports in 1959 as compared with 368 in Fiscal 1958. The aircraft are earmarked for assignment to the Military Air Transport Service upon 48 hours notice in the event of a national emergency.

Aircraft participating in the 1958 CRAF program represent 38% of the airline fleet participating in the program.

The 1959 CRAF will represent 32% of the commercial airlift for that period. However, because of increased load capacity of the more modern airplanes, it is estimated that total CRAF airlift will remain at approximately the present level.

In addition to the 1959 fleet, 35 aircraft were designated as contingent reserves to replace lost aircraft.

## Hughes Hopes to Lend $10 Million to TWA

**Washington**—Hughes Tool Co.'s plan to provide Trans World Airlines with $10 million in standby credit has been submitted to the Civil Acronautics Board for approval.

TWA is asking the Board to approve the agreement under which Hughes would make $10 million available to the airline. TWA could borrow against the credit until April 30, 1958.

CAB approval is necessary under the terms of the Board's 1944 order approving the acquisition of control of TWA by Hughes. When it approved the Hughes-TWA contract, the CAB limited transactions between the two companies to $200 each and a total of $10,000 a year.

Now, for the second time this year, TWA and Hughes are asking the Board to approve a major exception to the rule. Last May, the companies requested approval of a deal in which Hughes would build jet transports and sell 25 of them to TWA (AW May 21, p. 41).

The CAB scheduled a hearing on the jet transport proposal, but Hughes later asked that it be postponed. No further action has been taken on the plan.

The new credit proposal would allow TWA to borrow up to $10 million from Hughes on unsecured notes. Borrowings would be in multiples of $100,000, and the loans would bear interest at the prevailing prime rate for commercial loans in New York.

The initial amount of the credit would be $10 million. It would be reduced to a $7.5 million maximum on Aug. 1, 1957; to $5 million on Nov. 1, 1957, and to $2.5 million on Feb. 1, 1958.

## Dallas Case Limited To California Routes

**Washington**—Civil Acronautics Board has ducked a southern transcontinental route case for the time being and has confined the Dallas-to-the-West Case strictly to routes between Dallas and California.

The decision to limit the case was made on a split vote with CAB members Joseph P. Adams and G. Joseph Minetti favoring expansion of the case to points east of Dallas.

The Dallas-West Coast Case came about when the City of Dallas complained to the CAB about the adequacy of trunkline service to the West Coast. American Airlines has a monopoly on the route.

While the case was forming, several airlines filed applications which would have expanded it into a southern transcontinental case and would have included service to the Pacific Northwest and north-south service along the West Coast.

In its consolidation order, the Board decided to limit the case strictly to proposals for new service between Dallas and California via points in New Mexico, Arizona and Nevada.

The order left a loophole by saying that the airlines would have a chance to establish on the record that granting of an application in the limited case would "as a matter of economic fact" preclude granting of one of the excluded applications. If the airlines with rejected applications could prove this, the Board would have to expand the case.

The CAB majority said that the immediate question is whether additional Dallas-California service is needed and that expansion of the case would overshadow this issue.

The Board decided to exclude local service airline applications from the case and voted to require a mandatory stop at Dallas on any flights from the east or south operated over new routes granted in the case. And flights serving California points also would have to serve Dallas.

Airlines with applications included in the case are: Braniff Airways, Continental Air Lines, Delta Air Lines, Western Air Lines, American Airlines, California Eastern Aviation, Eastern Air Lines, National Airlines and Trans American Airlines.

Disagreeing with limits imposed by the majority, CAB Vice Chairman Adams said the case should include Houston and New Orleans as eastern terminal points. Minetti favors expanding the proceeding into a southern transcontinental route case.

# Report Favors Transport Census

**Washington**—A Commerce Department study group has found that the long-delayed census of transportation is needed to fill serious gaps in presently available transportation statistics.

Reporting to the Secretary of Commerce, Louis S. Rothschild, Under Secretary of Commerce for Transportation, recommended that the Bureau of Census ask congressional approval of a $1.2 million transport census to be conducted in 1958.

Rothschild's staff found that comprehensive transportation statistics are essential to the conduct of the nation's commerce, as well as to the administrative and legislative processes of the government, and the group found serious gaps in presently available data.

To fill these statistical gaps, Rothschild recommended a 1958 program consisting of these surveys:

- **Commodity distribution** by land, air and water.
- **Passenger travel** by land, air and water.
- **Truck transportation** inventory and utilization.
- **Bus transportation** inventory and utilization.
- **Air cargo** commodity movements.
- **Experimental surveys** to develop methods and techniques for handling major surveys.

The surveys are designed to supply information on the transportation industry not contained in the various statistics now published by the government. They will measure the sizes of the various industries and the markets and market channels in which they operate.

A census of transportation was first ordered by Congress in 1948 to be conducted in 1949 and every five years thereafter, but no funds were appropriated in 1948 or in 1953. The census went through a series of studies and was finally assigned to the Under Secretary of Commerce for review in April 1954.

This last study is now complete, and Rothschild has recommended that the Bureau of the Census make another attempt to secure funds for a transportation survey.

# MOST PROFITABLE AIRLINER

FOR 3/4 OF ALL AIRLINE FLIGHTS

# NEW LOCKHEED ELECTRA

Because of its wide-range operational flexibility, the new Lockheed ELECTRA is unsurpassed in performance and economy for all flights up to 2,500 miles.

Available in 1958, the ELECTRA will be the fastest operational transport. It cruises 65 mph faster with a payload of 85. This extra speed, plus time-saving ground-handling advantages, contributes to maximum profit potential.

Roomier cabins, all-new decor, wider seats, larger windows—all enhance ELECTRA passenger appeal. New quiet is achieved with Allison propjets and advanced soundproofing.

*American, Braniff, Eastern, KLM Royal Dutch Airlines, National and Western Air Lines have ordered for important routes 128* ELECTRAS.

## LOCKHEED

**AIRCRAFT CORPORATION**

*Burbank, California*

WORLD'S MOST EXPERIENCED BUILDER OF PROPJET AIRCRAFT

*Look to Lockheed for Leadership*

# CAB Reports on TWA, Riddle, Northeast, West Coast Accidents

By Craig Lewis

**Washington**—The Civil Aeronautics Board has issued reports on accidents involving aircraft of Trans World Airlines, Riddle Airlines, Northeast Airlines and West Coast Airlines.

The TWA and Riddle accidents were fatal crashes in which both aircraft were destroyed. West Coast and Northeast's accident involved only minor injuries to passengers and crews.

TWA's accident occurred at Pittsburgh last April when a Martin 4-0-4 crashed and burned immediately after takeoff. The stewardess and 21 of the 33 passengers were killed, but both pilots survived.

Immediately after takeoff, the pilot saw the left engine Zone 1 fire warning light come on, and he cut the left throttle to the point where auto-feathering was deactivated.

He then reached for the left manual feathering button, but the copilot, thinking that auto-feathering was still operative, dissuaded the pilot from pushing the manual feathering button and tried to get auto-feathering by pulling back the left mixture to idle cut-off.

The copilot was a TWA line check captain who was line-checking the pilot, a first officer, for captaincy.

The CAB found that this sequence of actions failed to comply with emergency procedures prescribed by the company for powerplant fire or failure. The investigation showed that the fire warning was caused by failure of an exhaust connector clamp which triggered a fire detecting unit.

The procedures followed by the two pilots resulted in a windmilling left propeller which, along with extended landing gear and takeoff flaps, produced enough drag to make the airplane lose altitude and crash.

The CAB said the cause of the crash was "uncoordinated emergency action in the very short time available to the crew, which produced an airplane configuration with unsurmountable drag."

### Riddle

The Riddle transport, a C-46, crashed in a cornfield near Hollywood, S. C., last December while on a scheduled cargo flight from New York to Miami. Both pilots were killed.

The CAB investigation determined that the C-46 disintegrated before it hit the ground, with the right outer wing, the tail surfaces and the left engine nacelle separating from the aircraft in flight. Downward failure of the right wing was the first in the sequence of structural failures.

The CAB report said numerous nonconformities were found in the elevator tab controls, making the airplane ineligible for airworthiness certification. The Board said both the Civil Aeronautics Administration and the airline should have detected the parts which did not conform with regulations.

The Board found that erratic action of nonconforming elevator control tabs caused the C-46 to pitch down violently enough to make the right wing fail.

### West Coast

The CAB found that a West Coast Airlines DC-3 crashed at Pullman-Moscow Airport last February because the pilot abandoned his approach too late to avoid a hill near the runway.

The accident occurred during an approach to the Pullman, Wash., airport on Feb. 26 at about 7:40 PST. As the pilot began to execute a missed approach, the DC-3 hit a hill about one-and-one-quarter miles northeast of the runway and crashed in a snow-covered field. The copilot and two of the 12 passengers were slightly injured.

During the approach to the runway, visibility was reduced to zero for about 10 seconds by a snow squall, then the airport lights were sighted again. When the lights were obscured for a second time, the pilot started a missed approach procedure, but before the airplane started to climb, it hit a hill about 50 ft. from the crest. The CAB said the nose-up attitude of the DC-3 reduced the force of impact substantially.

The Board said the cause of the accident was "the continuation of a landing approach following loss of visual reference to the airport, and the delayed attempt to execute a missed approach."

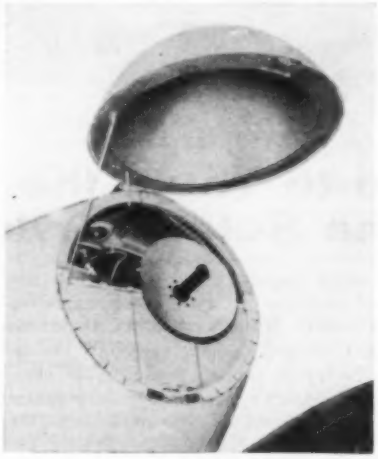
### Northeast

Last March, a Northeast Airlines Convair 240 landed in deep snow to the left of a runway at Portland, Me., Municipal Airport. The nose gear collapsed, damaging the airplane. Five of the 32 passengers suffered injuries.

A row of airport boundary lights running parallel to the left row of runway lights created the illusion with the Northeast crew that the runway was to the left of its actual position. Landing at night, in light snow and with limited visibility, the pilot set the Convair down in deep snow to the left of the runway.

The CAB report found that the first eight lamps in the right row of runway lights were inoperative and that the three green threshold lights were not all fully operative. These conditions contributed to the illusion.

The CAB blamed the accident on inadequate maintenance of runway lights and incorrect reporting of their condition by the airport management. Airline employes were criticized for incorrect reporting of lighting conditions.



## Business Aircraft Radar

**Smallest, lightest airborne storm-warning radar yet announced, weighing only 50 pounds, has been developed by Radio Corporation of America. New radar, which weighs about 40% as much as airline radars, has 50-mi. range compared to 150 mi. for airline version. Several other companies, including Collins Radio, reportedly are developing lightweight weather radars.**

## New Argentine Airline To Operate Abroad

**Buenos Aires**—A new Argentine airline has been formed with private capital for foreign and domestic flights.

This became possible only recently with the signing of the country's new aviation law, which repealed Aerolineas Argentinas' monopoly on intra-Argentine flights and opened the way for only four companies controlled by Argentine nationals.

The new firm, Transcontinental, S. A. starts activities with capital of $2.2 million. The firm will begin at Buenos Aires-New York flights in May of next year, and plans in 1958 to inaugurate service to San Francisco, with connections to the Far East.

Super-Constellations (1049H) will make the international flights. The new firm has acquired five of their planes, on what is described as a hire-purchase system, from California Eastern Aviation, Inc., with the help of the Bank of America. Purchase price was 12 million dollars.

# From Tokyo to Thule the Air Force meets the Solar Serviceman

**GAS TURBINE ENGINES** are gaining ever wider use in military service . . . for airborne generator sets, ground support units and many other applications. Solar Field Servicemen constantly visit Air Force bases and Armed Service evaluation centers establishing training programs and checking installations. Solar's Field Servicemen are a vital part of the team that has produced the trouble-free record of Solar gas turbines.

Solar builds both the Mars 50 hp and the Jupiter 500 hp gas turbine engines. The Mars is now in use on the Lockheed C-121C, Douglas C-124C, Convair C-131B and the Boeing KC-97 tanker. The Jupiter is being produced as a compressor pack and in variable and constant speed versions for other applications.

The proven dependability of Solar gas turbines is the result of nearly three decades of experience in engineering and fabricating precision products of alloy steels for severe service. Can this experience help you solve a complex engineering or manufacturing problem? For information write Dept. C-68, Solar Aircraft Company, San Diego 12, California.

**WRITE FOR BOOKLET**...new brochure describes Solar gas turbines – how they work, advantages they offer to forward-looking industries. Send for a copy today.

**SOLAR**
**AIRCRAFT COMPANY**
SAN DIEGO DES MOINES

**ENGINEERS WANTED** *Unlimited opportunities in Solar's expanding gas turbine program! Write today, giving experience.*

**Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products**

# ATA Official Pushes Program For Blanket Air Traffic Control

By Katherine Johnsen

**Washington**—Milton Arnold, vice president of the Air Transport Association, has urged that planning and research be launched immediately on a system that would blanket the continental air space with positive traffic control.

In testimony before the House Commerce Subcommittee on Aviation headed by Rep. Oren Harris (D.-Ark.), Arnold termed the present three-year federal airways plan formulated by the Civil Aeronautics Administration as "only the initial step."

Under the present plans, positive control would be provided to more than 15,000 ft.

"It is the strong feeling of the airlines," he said, "that a system of complete air traffic control must be developed to provide separation and organization of all traffic, regardless of weather conditions, except in certain specific areas, principally at low altitudes, where the nature and density of traffic does not require such strong handling. It will not come without groans and squeals from those who feel that they are being deprived of so-called 'freedom of the skies'."

He anticipated, however, that the system can be applied "without imposing an undue hardship on private flying."

### No Areas Exempted

Harris and other members of the subcommittee have gone a step further than Arnold with the suggestion that no areas be exempted from the controlled system.

Other developments at the hearings included:

• **Louis Rothschild**, Under Secretary of Commerce for Transportation, disclosed that the administration will recommend a plan within the near future for assessing users to finance federal airways development.

• **Arnold reported** that the Association of Automotive Engineers and several other groups are working on cockpit configurations designed to increase the area of pilot visibility.

• **American Telephone and Telegraph Co.** has agreed to license its Tacan patents—to help increase production of Vortac units for the common navigation system. Vortac units, Rothschild told the subcommittee, will cost between $5,000 and $6,000 each.

### Airways Charges

The two key issues on airways user charges have not yet been resolved, Rothschild said. These are:

• **Whether users should be required** to finance the installation cost, or only the operations cost.

• **What the yardstick for charges** should be—fuel consumed, landings, aircraft miles, etc.

He noted that the military services account for over 50% of the use of the airways.

"The economy and defense of the country," Arnold testified, require "a comprehensive, thoroughly integrated master plan designed to accommodate all types of aircraft—and require it immediately."

He also stated that, in addition to the improvements embraced in CAA's three-year plan, this master plan should provide:

### Master Plan Proposal

• **"Complete and constant control** of all traffic at the higher, more-critical altitudes, where our faster aircraft must operate, as well as in all high density traffic areas."

• **"A new method of semi-automatic visual** communications link between pilot and controller to reduce voice communications and the resulting workload on the controller."

• **"A new method of supplying** to the controller the information he needs for preparing clearance information for the pilot. We visualize an electronic reservoir of data such as aircraft position, altitude, speed, direction and identity for every flight—all of which is capable of being displayed automatically to the controller."

Because air traffic control now lacks these modern devices, Arnold observed, there is "an excessive assignment of airspace to each flight . . . causing unreasonable restrictions on flight operations. If proper equipments were employed, we could decrease the required airspace allocation per aircraft, yet maintain the same level of safety."

### Immediate Steps

So far as immediate steps are concerned, Arnold proposed:

• **Additional airways.** He noted that although the Civil Aeronautics Board has authorized scheduled airline service in many new cities, the airways connecting these cities have not been provided.

• **Additional control tower personnel** in anticipation of expanding airways activities. Deploring the low salaries paid control tower operators, Arnold commented: "The pressure and strain of the work is fast showing its effects in the physical and mental health of controllers who are assigned a straight eight-hour work shift with no scheduled lunch or rest periods. If this is our experience in a time when only about 15% of all traffic is controlled, what are we to expect if practically all traffic is to be controlled?"

# Pan Air Buying DC-7s With PAA Financing

**Rio de Janeiro**—Brazil's Superintendency of Currency and Credit finally approved request of Panair do Brasil airline to buy four DC-7C aircraft and spare parts at a cost of $13.7 million.

Financing will come from Pan American World Airways which owns 48% of Panair stock.

Panair also is getting Pan American's place in line for the new planes, which are scheduled for delivery in April or May of 1957.

Panair now uses 10 L-49 Constellations for flights from Brazil to Europe and the Middle East, and to other South American countries. The new planes will take over the long European and Middle Eastern flights, allowing the company to use its Constellations for "local" flights around South America.

# SHORTLINES

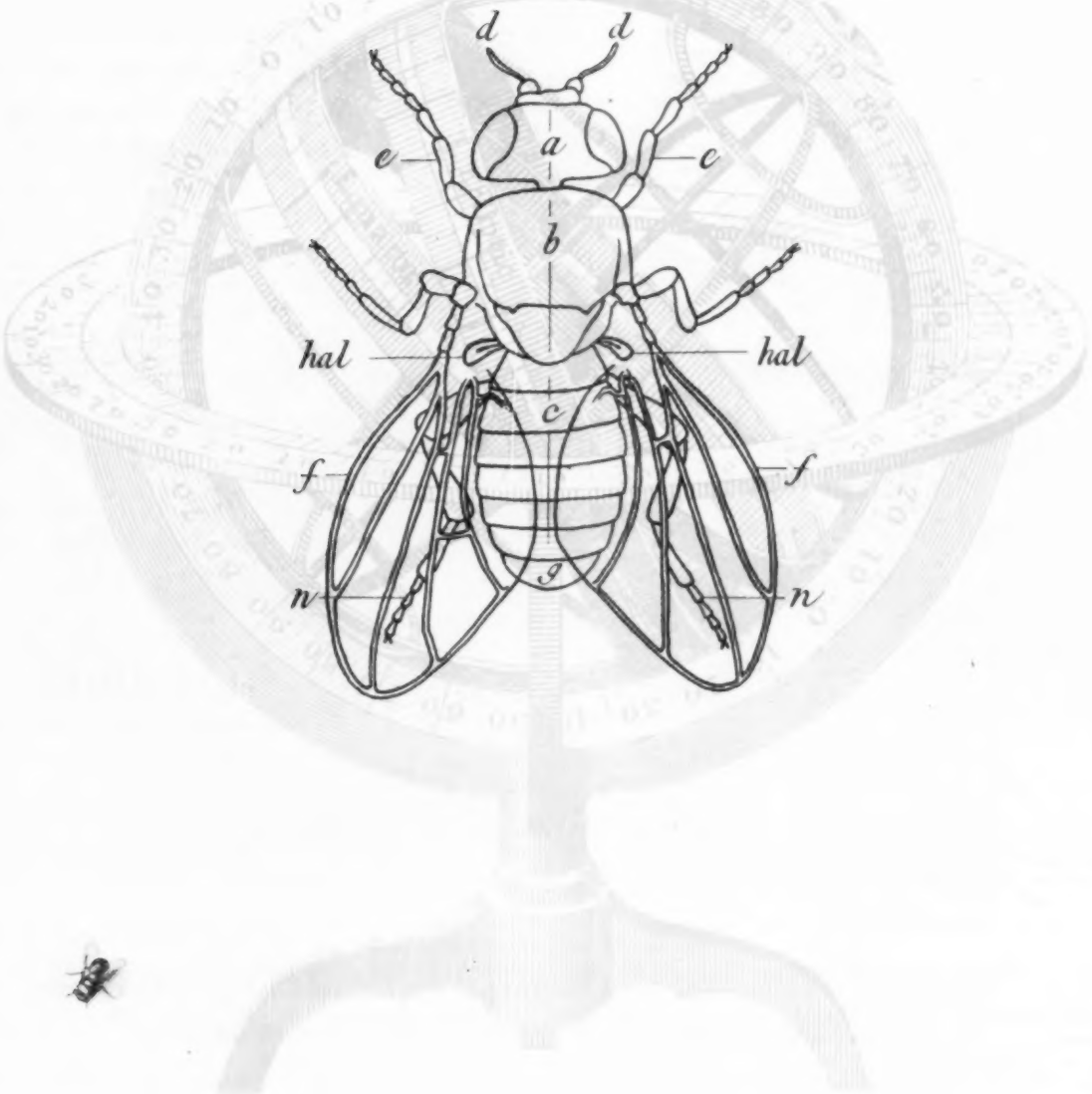
► **Aer Lingus'** London-Dublin traffic registered a 20% increase in August for a total of 29,000 passengers. The Irish airline's overall traffic reached 85,000 passengers, 18,000 more than were flown in August of 1955.

► **Air India International** will start a new Australian service on Oct. 5. The Super Constellation service will operate once a week between Bombay and Sydney via Madras, Singapore and Darwin and will connect with Air India European flights for through service between Sydney and London, Dusseldorf, Rome and Cairo.

► **Allegheny Airlines** flew 6,692,000 passenger-miles in August, an 11% increase over August 1955. Traffic in the first eight months of the year totaled 42,266,000 passenger-miles, a 16.4% increase.

► **Chicago Helicopter Airways**, formerly Helicopter Air Service, completed seven years of scheduled operation last month. The carrier hauled 21 million pounds of mail and completed more than 45,000 hr. of flight time in the seven year period.

► **Delta Air Lines** has put its first Convair 440 Metropolitan in service. Delta






## Two-Hundred-Million-Year-Old Inertial Navigator

EONS AGO the fly had two sets of wings. His second set of wings shrivelled into the vibrating gyros entomologists call halteres. The fly now flies with his own inertial guidance system, efficient enough for his needs and marvelously compact. Our interest in the anatomy of the fly is the interest of an inertial-guidance-systems Engineer. We construct inertial guidance systems. Those bearing the Litton Industries name have a simplicity of design and compactness unsurpassed in this complex field. They are designed to function at Mach Numbers that are classified.

**LITTON INDUSTRIES** BEVERLY HILLS, CALIFORNIA

*Plants and Laboratories in California, Maryland, Indiana and New York*

DIGITAL COMPUTERS AND CONTROLS · RADAR AND COUNTERMEASURES · INERTIAL GUIDANCE · PRECISION COMPONENTS
MICROWAVE POWER TUBES · AUTOMATIC DATA PROCESSING SYSTEMS · SERVOMECHANISMS · SPACE SIMULATION RESEARCH

has seven more of the radar-equipped transports on order.

► **Ethiopian Airlines** has increased its services to Cairo and Athens from five to six flights a week. The airline now operates three Convair 240s along with its DC-3 fleet.

► **Hunting Clan Air Transport Ltd.** is negotiating for three Bristol Britannia 310s for mid-1958 delivery. The carrier has ordered one Britannia and is taking options on two more.

► **Mohawk Airlines** is adding a lounge to its Convair 240s that increases capacity to 42 seats. The modification is the first step in a program that will eventually increase capacity to 46 seats . . . Mohawk carried 32,670 passengers in August, an increase of 25.8% over August, 1955.

► **National Airlines** opened a sales office in Houston on Sept. 10 to prepare for operations over the new Houston-New Orleans route the Civil Aeronautics Board is giving the airline.

► **North Central Airlines'** August traffic totaled 56,467 passengers.

► **Northwest Airlines** now offers complimentary pictures to passengers on Seattle-Honolulu flights. Stewardesses take the pictures with Polaroid cameras which develop immediately.

► **Ozark Air Lines** handles ticket reservations for Chicago Cardinal football games through its teletype system. Fans can make reservations in any of the 45 Midwestern cities Ozark serves. The local carrier has previously done the same thing for the St. Louis Cardinals, Chicago Cubs and Chicago White Sox baseball teams and the Chicago Bears football organization.

► **Pan American's Latin American** Division will fly 4,500 salesmen and their wives to the Dominican Republic this fall for the Fedders-Quigan Corp. Fedders-Quigan is awarding one-week Caribbean vacations as prizes in its sales incentive campaign, and Pan American will fly 70 round trips between the U.S. and Ciudad Trujillo in a ten-week program. . . . Latin American Division reports summer traffic was up 17% over 1955.

► **Raleigh-Durham Airport** Authority reports 9,943 passengers enplaned in August, a 35% increase over the previous August. The Authority's goal is 130,000 passengers boarded in 1956.

► **Varig Airlines** of Brazil has signed an interline agreement with Civil Air Transport of Formosa.

# AIRLINE OBSERVER

(EDITOR'S NOTE: *The following column was written by the* AVIATION WEEK *staff attending last week's 12th annual general meeting of the International Air Transport Assn., Edinburgh.*)

► **Thirteenth annual general meeting of the International Air Transport Assn. will be held in Madrid next September.**

► Sncase is designing a new and larger version of its Caravelle jet transport aimed at larger capacity, more speed and increased range. It will still remain in the medium-haul jet transport class, however. New Caravelle will be powered by 16,000-lb.-thrust developments of the Rolls-Royce Conway bypass engine series in which the percentage of bypass air is higher than in current versions.

► **British airframe and engine manufacturers made unprecedented sales efforts at 12th IATA annual general meeting, with the attendance of their top technical and sales personnel, a full schedule of entertainment for the IATA delegates and rides in the Napier-Eland-powered version of a Convair Liner and the Bristol 300-series Britannia. For the first time in recent IATA meetings, U. S. manufacturers' efforts took a definite back seat to British salesmanship.**

► Bristol Britannia's entrance into BOAC service has been delayed another six months until spring by the recurrence of intake icing problems in the Proteus turboprop engines, causing engine flameouts. Latest flameouts due to engine icing occurred during tests in Calcutta monsoon during BOAC proving flights to Australia. Problem revolves around stagnant air areas in peculiar Proteus air intakes at rear of engine. Bristol is dispatching another test Britannia on African icing flights with television cameras installed to monitor engine air intake areas to show what is actually happening under icing conditions on television screens in the cabin. Royal Aircraft Establishment at Farnborough and British National Gas Turbine Research facility also are being called in to aid Bristol in finding a quick solution requiring minimum modifications of the engine and intake structure.

► **Sales battle between Pratt & Whitney J75 and Rolls-Royce Conway bypass engine is now the hottest sector of the jet-transport-market competition. Rolls has a 14,500-lb.-thrust Conway running and plans first test stand run of its 16,000-lb. version in December. Pratt & Whitney has had J75 running at 16,000 lb. thrust for several years. Neutral observers are betting that Rolls won't dent the Boeing or Douglas transport engine market to any degree outside England and Canada.**

► Russian delegation of top Aeroflot officials received French official clearance to visit Sncase in early October for technical discussions concerning the Caravelle jet transport. Russians have been saying for six months that they are intensely interested in buying some Caravelles for Aeroflot operations, but the French government delayed official clearance until recently. Caravelle in present version is powered by 10,000-lb.-thrust Rolls-Royce Avon Mark 29 turbojets.

► **Vickers is considering design of new four-jet, medium-range jet transport based on four Rolls-Royce Conways mounted either in wing pods or in a cluster at the rear of the fuselage. British European Airways already has indicated it will need a half dozen medium-range jets to compete with Air France Caravelles on the London-Nice run and other high density European routes. Key to Vickers decision probably will be Trans-Canada Airlines' choice for future medium-haul epuipment. If TCA will buy the Vickers medium-haul jet, there is a strong likelihood that the project will become a reality.**

► Airline observers are speculating whether there will be any alliance between Aristotle Onassis' rejuvenated Greek National Air Line and United Air Lines. Presumably, angles would involve United providing technical assistance in expanding the Greek air line's international operations plus feeding U. S. domestic traffic into the Greek foreign system via New York.

## AIR-TURBINE DRIVES . . .

# The Answer to Jet Age Accessory Power Problems

The need for hydraulic, electric, and mechanical power multiplies with every major advance in aircraft performance. The high air speeds of today's jets demand more hydraulic power for aerodynamic surface and braking control. Widespread use of electronic equipment has greatly increased electrical requirements. The blistering surface heat of high-performance planes only compounds the problem. Not only must today's designer plan an accessory system that can meet increased power requirements, in much less space, but he must be sure it can operate in hot environments.

Some accessory equipment now in use is grossly affected by heat. Direct drives attached to the engine, hydraulic motor drives, and gas turbine power units (GTPU's)—are extremely vulnerable to high ambient temperatures. In addition, they generate so much heat in operation that a method of removing the heat must be employed. Other limitations, such as inadequate lubricants, heat pumps, or the absence of extremely high-temperature metals may preclude the use of these methods if thermodynamic requirements continue to grow.

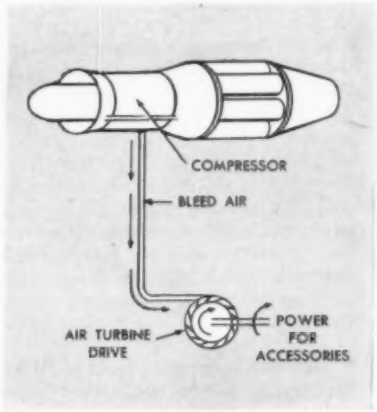
### Heat Problem Changes The Design Picture

The heat problem has become so complex that top engineers now realize the importance of integrating the accessory system as part of the basic powerplant and airframe design effort. In the absence of adequate alloys to withstand high skin temperatures, designers now see the advantage of installing thermal-conditioning equipment and airducts as part of the airframe design in order to cool surface areas as well as internal components.

As a reliable, convenient source of compressed air, the jet engine provides the way to solve many of these problems. Air, extracted from its compressor, can be ducted to nearly any part of the aircraft surface for purposes of cooling, boundary-layer control, and deicing. Since the weight of this equipment is chargeable to the aircraft mission, it becomes practical to use the common energy source—compressed air—for operation of the plane's entire accessory system.

### Air-turbine Drives Permit Integrated System

This trend casts new importance on the role and selection of accessory systems. With a compressed air supply already integral with the airframe, the use of air-turbine drives permits more effective integration of the airframe and the accessory system. In many installations, the same air used in the existing airduct system can be used to spin small turbine wheels mounted on shafts. These, in turn, drive generators, hydraulic pumps, fuel pumps, thermal-conditioning equipment, mechanical actuators, and other accessories.




**Turbines Run on Air Ducted from Compressor**

Operating on this simple principle, air-turbine drives can effectively perform nearly every accessory function aboard jet or turboprop aircraft.

### Simpler Construction—Greater Reliability

Air-turbine drives are inherently more reliable because they require fewer moving parts than any other method of generating power. Only one efficient, rotating turbine wheel and shaft is required to drive the plane's electrical and hydraulic units. Completely automatic operation is obtained by an integral control system. Whenever a load demand occurs, a system of signaling and actuating devices changes the unit's output to meet the power requirements.

Reliability of an air-turbine drive system is achieved by cross-manifolding the plane's air supply ducts. Through this method, all units on the aircraft can operate from one or any combination of engines. In multi-engine aircraft, failure of one or more engines would not mean loss of accessory power as long as one engine remained to supply bleed air.

The operating history of units now in use, such as those on Boeing's B-52, shows that the simple, comparatively friction-free construction of air-turbine drives can greatly minimize wear and result in longer, more dependable service. In addition, they permit more effective paralleling of generators if required, and with a ground source of air, can be tested without running the main engines.

### Install Where Power Is Needed

**Air-turbines Permit Functional Location**

Air-turbine drives and the accessories they operate may be located anywhere in the plane where power is needed. In the B-52, for example, ten hydraulic turbopumps are distributed in both wings and the fuselage—close to the point where power is needed. Such versatile, functional location is possible because air is relatively easy to transport and because it requires no return system.

Located away from the engine, these drives can contribute to a sleeker airframe design by cutting engine nacelle size and reducing frontal areas. Also, by installing them close to the "service area," short hydraulic and electric transmission lines can be used. This results in a lighter and less complex system.

These advantages permit a significant increase in aircraft speed and range, or payload.

### Forecast for the Future

**Ramjet and Nuclear Powerplants**—It is expected that air-turbine drives will play an increasingly important role in the future. In aircraft utilizing a turbo ramjet,

the turbojet portion of the engine may be shut down during the supersonic portion of flight. This would mean that no mechanical power would be available from the main powerplants for accessory operation. A pneumatic system, however, could provide accessory power under such conditions.

Another indication that more accessory power will be needed in the future exists in the anticipated requirements for nuclear-powered aircraft. Large amounts of power may be needed for specialized functions associated with the reactor. Remotely located air-turbine drives, linked with an auxiliary power unit, could supply a huge block of power without a prohibitive increase in unit weight or size.

## G.E. Pioneered Air-turbine Drives

General Electric's Aircraft Accessory Turbine Department in Lynn, Mass. is one of the nation's prime suppliers of air-turbine drives for aircraft accessory power.

Drawing on G.E.'s vast experience in producing industrial and aircraft gas turbines, this department has consistently advanced the state of turbomotive equipment design.

Just as General Electric pioneered the "radical" aircraft turbosupercharger in 1918, through the Aircraft Accessory Turbine Department, it is now building air-turbine drive equipment to answer the accessory power problems of the jet age.

**G-E Turbopumps and Turbodrives** help supply all hydraulic and electric power on the Boeing B-52 Stratofortress, first aircraft in history to use pneumatic-driven power equipment for operating its entire accessory system.

Driven by air ducted from the jet engines, G-E turbopumps and alternator drives supply 8 gpm at 2650 psi and 60 kva at 400 cps, respectively. They give the big bomber power for operating steering, control surfaces, landing gear, bomb-bays, spoilers, radar, lighting, and armament.

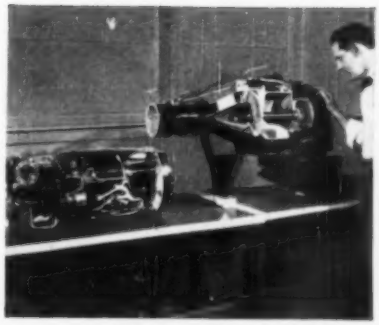
## G-E Fuel Turbopump

This tank-mounted, air-driven unit provides 86 gallons of vapor-free fuel per minute, giving North America's F-86D interceptor the extra fuel needed for afterburner operation. Characteristic of G-E air-turbine drives, the Afterburner Fuel Pump is lightweight and compact and can be functionally located in the aircraft.

## G-E Turbostarters

Another application of the versatile turbine is in the self-contained turbostarter (used on the Martin B-57) which starts a jet engine in less than 10 seconds.

It is powered by hot gases resulting from the combustion of an easily replaceable solid-propellant cartridge. Turbostarters eliminate the need for ground power starting units, minimize logistics problems, and increase jet aircraft availability.



G-E Turbopumps and Turbodrives Help Power B-52's Accessory System

G-E Afterburner Turbopump Gives North American F-86D Instant Power Reserve

G-E Turbostarter Gives Martin B-57 Quick Starts. G.E. Also Makes Fuel/Air Starters

## Advanced Air-turbine Drives Are "In the Works"

General Electric's Aircraft Accessory Turbine Department, with facilities valued at more than $15 million, is carrying out an extensive development program on advanced air-turbine equipment. Units with extremely high power-to-weight ratios are already in advanced stages of testing. These programs promise powerful answers to accessory power requirements that lie ahead.

To find out how G-E air-turbine equipment can help you now in the planning stages, contact your General Electric Aviation & Defense Industries Sales Office or write for the descriptive brochures on the drives you are interested in.

General Electric Co., Section A231-8, Schenectady 5, N. Y.

Please send me the following brochures on G-E Air-turbine Drives

- ☐ GEA-5870A Air-turbine Drives For Jet Aircraft
- ☐ GEA-6333 Hydraulic Turbopumps For Modern Aircraft
- ☐ GER-1088 Gas Turbine Starters For Jet Aircraft
- ☐ GEA-5871A Aircraft Afterburner Fuel Pumps

Name .....

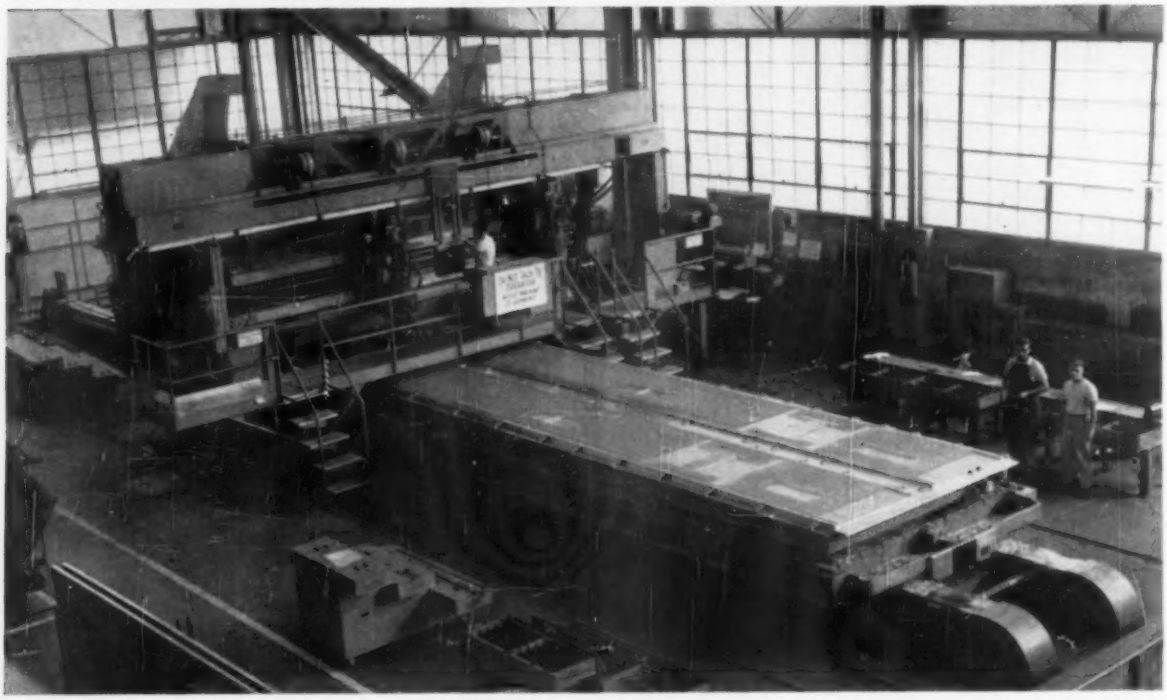
Position .....

Company .....

Street .....

City ..... State .....

GENERAL ELECTRIC



**HUGE SKIN MILL** at Lockheed is forerunner of type of machine tool which will be used to sculpture, taper and cut integral stiffeners in structural components of future aircraft. Machine also may be tape-controlled.

# Air Future Taxes Production Methods

By Irving Stone

**Burbank, Calif.**—Advanced aircraft designs engineered in the next decade will tax the ingenuity of the manufacturing team to translate them into finished hardware. Some of the factors involved are:

- **Projected sharp** rise in military aircraft performance, ushering in the extensive use of high strength steels and titanium alloys. These materials generally will be harder to work, will introduce manufacturing complications.
- **Reduced aircraft** space for accommodating equipment.
- **Increased machining** and forming requirements.
- **More precision** in tooling fabrication and assembly.
- **Closer process control.**

These and many other considerations will combine to burden manufacturing with problems demanding, for their solution, new approaches as well as modification of existing production techniques.

New levels of technical ability will be required in many phases of manufacturing. Manufacturing research will take on new importance. Closest coordination between manufacturing and engineering groups will be required.

Engineers at Lockheed Aircraft Corp., under J. B. Wassall, director of engineering, and Herbert Caldwell, manufacturing manager, have been studying the probable effects of design trends on future manufacturing.

Burt C. Monesmith, Lockheed vice-president and general manager of its California Division, outlined some of the highlights brought out by the study.

## Installation, Checks

Increased emphasis in the future production cycle will be on the installation and checkout of electronic, electrical, hydraulic and pneumatic equipment. This work, already difficult, will prove more so in the future and may raise production man-hours considerably if specialized training of personnel is not adequately planned.

Initial difficulty will be the limited space available, particularly in future military aircraft, for this equipment. Packing the units into tighter quarters will boost the burden of the installer and tax his skill, Monesmith said.

The checkout phase in the plane also will be a serious complication, and will be aggravated by the limited space, increased amount and complexity of equipment, and its automatic action. Prior to installation almost all of this equipment will require a high degree of qualification testing in addition to adequate bench testing.

More technical personnel will be required, specially trained in the systems they are installing or checking.

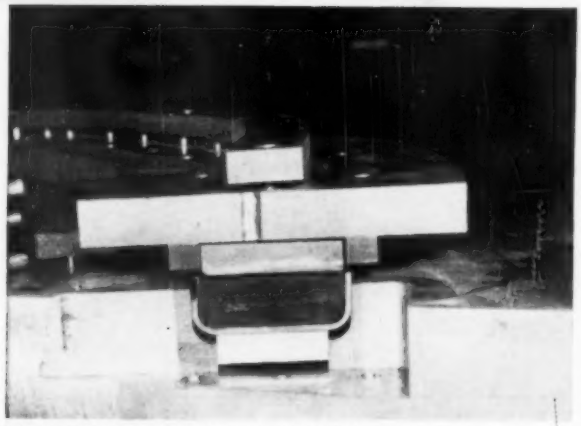
In connection with equipment installations, increased use of metal mockups duplicating the plane in detail, is anticipated. Constructed concurrently with the design phase, they will be used to simplify clearance and access problems.

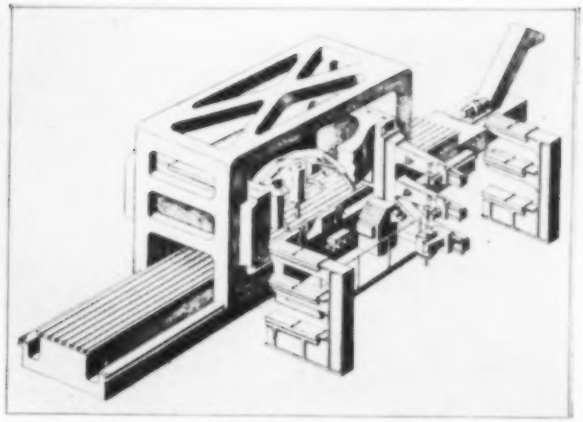
## Machining

More machining is generally seen in the picture for future aircraft because of emphasis on weight reduction and integral stiffening.

Shift to steel and titanium alloys may introduce reduced speeds for some cutting operations, and machine tools for these harder materials will require more power and rigidity. Machines and coolant supplies may have to be restricted to particular materials to avoid contamination.

Magnetic or punched tapes may be used for control of milling operations instead of mechanical methods now employed, if production quantities warrant, but this new technique initially will complicate the production job be-





**COMPRESSION-FORMING** principle (left), used here for C-Section, is being considered for bending pressure lines and ducts in future aircraft. Five axis miller (right), to be installed at Lockheed next year, will be used for difficult variable angle profiling of airfoil sections, such as forged ribs. Cincinnati Milling Machine Co. is building the unit, designed by Lockheed under USAF contract.

cause of the specialized training the data processing will require.

Wider application of sandwich structures will mean more contour machining of honeycomb core, in steel and titanium alloys as well as in aluminum alloys.

To withstand cutting forces, support methods with sufficient rigidity will have to be developed for the cores.

### Machining Load

The use of extruded integrally stiffened skin instead of sculptured or tapered sheet will tend to lessen the machining load. Also, abrasive belt grinding and chemical milling will find greater application to replace or supplement conventional milling procedures. While easing the machining task, the grinding and chemical milling procedures will mean additional production loads in these operations and will require additional floor space.

Smooth contours required for very high speed flight will involve fabrication of parts to closer tolerances. There will be an increased need for secondary sizing operations to set formed parts to exact contours.

Many of the forming operations, such as those for titanium alloys and steels, will have to be performed at elevated temperatures, adding the complication of heating to the production job and requiring adequate training of personnel.

Higher forming pressures generally will be required, particularly for steel and titanium alloys. Load on tool shops will be heavier because of increased number, complexity and closer tolerance of tools and the need to make them of harder materials. Shops will require more grinding equipment and generally heavier machine tools.

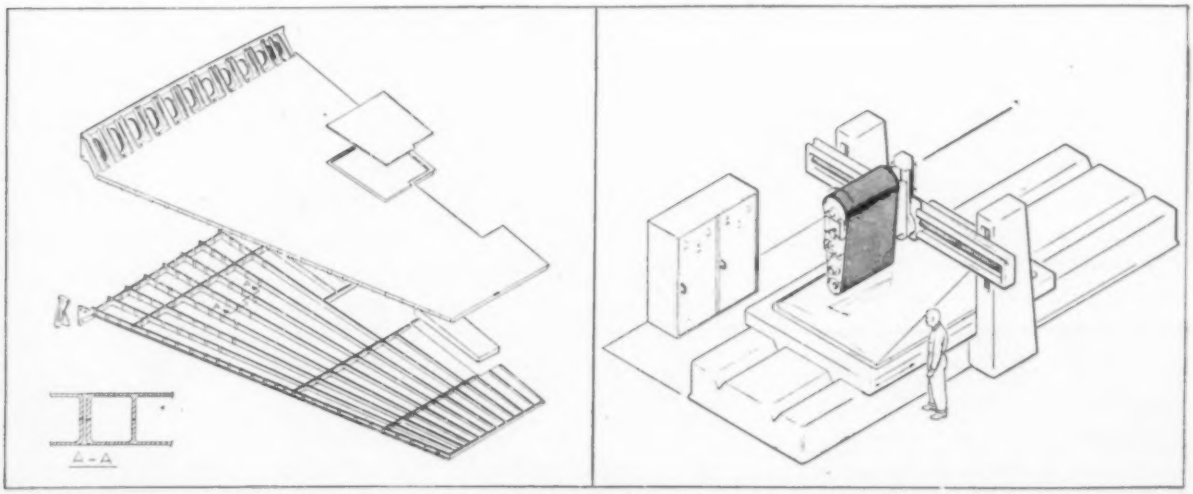
High velocity forming, using explosives as power, is seen desirable for many parts, and necessary for some of the harder alloys. This will introduce shielding problems and the requirement for comprehensive safety training.

Stretch press capacity also will increase from the present 200-300 tons to 1,000 tons within ten years, Monesmith estimates. This will result primarily from greater use of stainless steels and heavier gage materials.

### Compression Forming

Impact extrusion presses will require more tonnage to handle steel and titanium alloys. Capacity is seen rising to 300-400 tons as against 100 tons now used for aluminum alloys.

Considerable tube forming will be done on pressure lines and ducts made from steel, titanium alloy and Inconel. Compression forming will be required to avoid wall thinning, and some forming will have to be done at elevated temperatures. Pressure lines will have




**PROPOSED WING** structure (left) forged as two half shells would reduce assembly operations, but would require drilling of bosses and machining or grinding of mating faces and outer contour. Increased abrasive-belt grinding activity might use this proposed automatic contour grinder (right) for aircraft wing.

Five colorfully compact folders will introduce you to the engineering and development services of our aircraft division.

For information on engineering services, prototypes and production of aircraft and mechanical components contact:

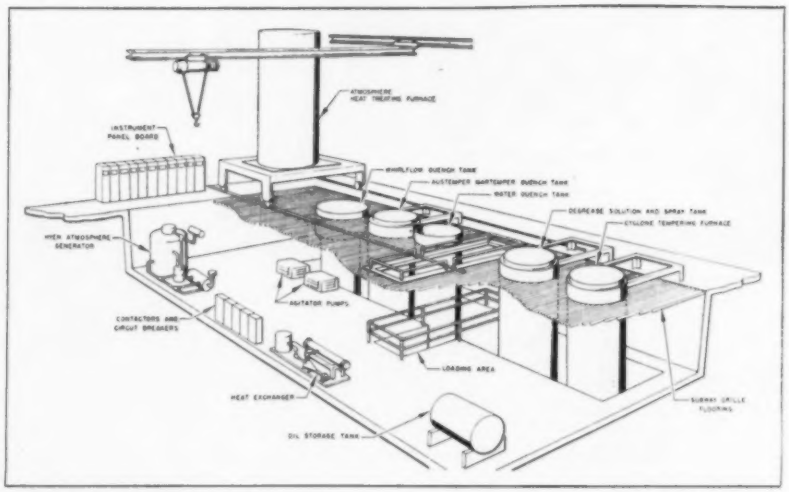
*Contracts Administrator*

**BRISTOL engineering corporation**

*SUBSIDIARY OF HUNTER MFG. CORP.*

**AIRCRAFT DIVISION**

**BRISTOL, PENNSYLVANIA**




**TRAVELING CONTROLLED** atmosphere vertical furnace is being installed at Lockheed for heat-treating steel to high tensile strengths for present and future requirements.

to be pressurized up to the material yield strength to boost fatigue life, requiring development of lengths and bend angles to compensate for change of shape under yield pressure load.

Surface finish of blanked edges is estimated at 250 RMS, or better, on many parts, with steel and titanium alloys requiring harder blanking tools than alluminum alloys. Carbide or hard-faced dies will be required.

### Processing

Process control will become a more important aspect of the production cycle. Generally, all processing will require closer controls, involving continuous recording and control instrumentation in many cases.

Some relatively new processes will be used, and use of other processes extended, including vapor honing for polishing steel surfaces; chemical milling for steel and titanium; new type of cadmium plating for steel; ceramic coating, primarily for steel; new paint finish systems, requiring baking at elevated temperatures; gas plating, principally for tools for plastic parts; hard anodizing for aluminum wear-surfaces; shot peening, both for forming large parts and for controlling surface residual stresses, with more precise control over area and intensity of peening than is now available.

Hot salt baths may be required for proper cleaning and pickling of titanium alloys.

Vacuum or inert gas atmosphere will be required for heat treating new steels and titanium alloys, which will have to be supported in the furnace and during quench. In the heat-treat cycles of some materials, temperatures down to −100F will be used.

If satisfactory optical and light transmission properties can be achieved, high temperature transparent phenolics, epoxies and silicones probably will be developed.

### Transparent Parts

Ultimately, transparent parts will be made of heat- and shock-resistant glass or possibly fused quartz.

A large share of the work in developing high-temperature transparent parts will have to be performed in the plane builder's engineering and manufacturing research laboratories.

Increased emphasis will be put on fusion welding for joining steel or titanium alloys. Both automatic tungsten inert gas and metallic inert gas welding equipment will be used. Because there may be a considerable amount of fusion welding for major assemblies, the welding equipment may have to be placed in a large proportion of the assembly area.

There will be more brazing with steel and titanium alloys, particularly in sandwich construction using honeycomb core. Brazing will be done in vacuum or inert gas, and probably will require continuous recording and control instrumentation. Support tooling will be used to prevent sagging of parts in the furnace and to control warpage during cooling or quench. Non-destructive inspection techniques will be used, probably including ultrasonics, X-ray, and radioactive isotopes in the braze alloy.

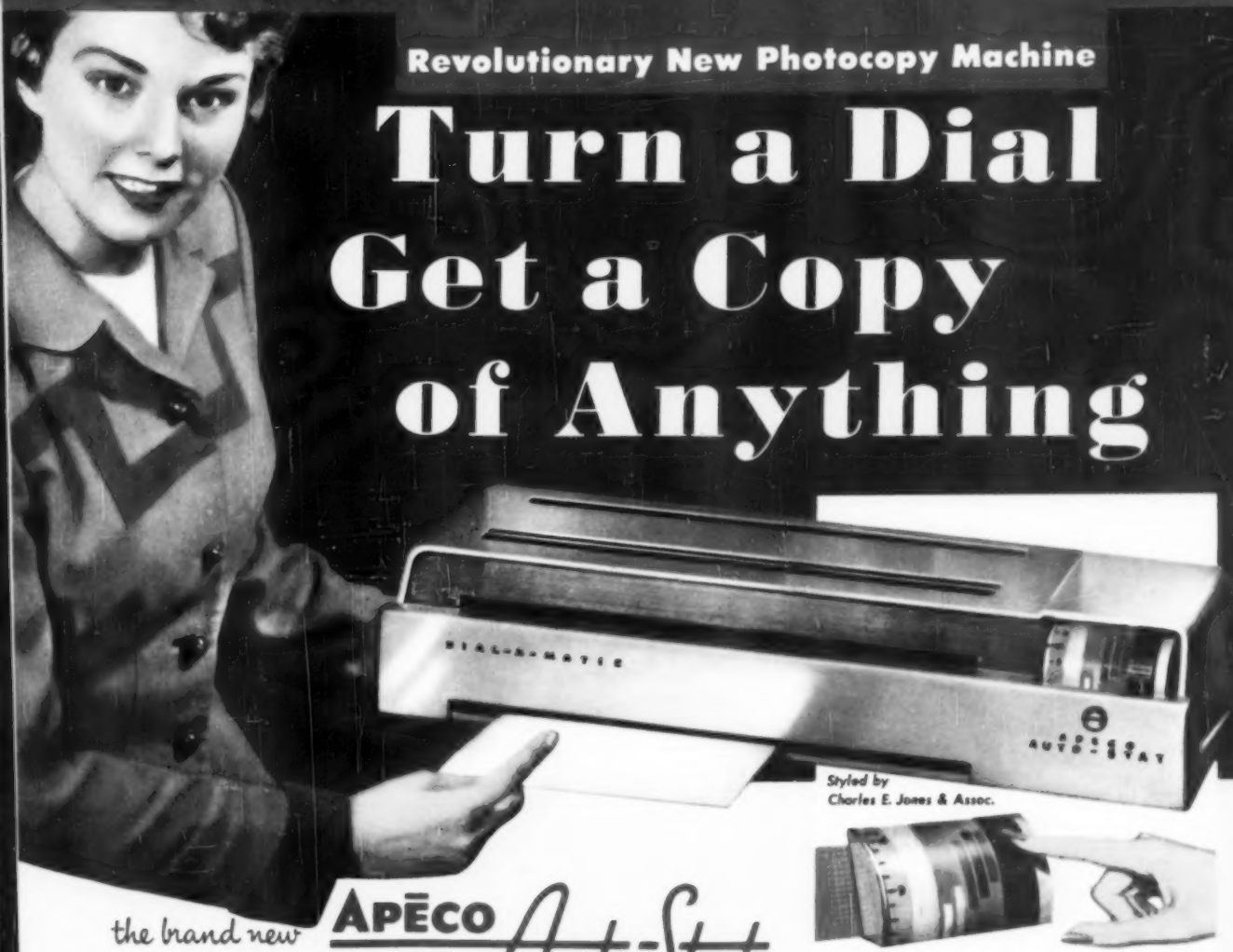
### Bonding

Use of metal-to-metal bonding will increase considerably as a primary attachment method, as a secondary method in conjunction with mechanical fasteners, and as a sealant.

Much of this bonding will be applied to large assemblies such as fuselage panels or barrels, perhaps even to com-

Revolutionary New Photocopy Machine

# Turn a Dial Get a Copy of Anything




Styled by Charles E. Jones & Assoc.



the brand new **APĒCO DIAL-A-MATIC Auto-Stat**

**Now Get instant photocopies of anything written, printed, typed, drawn or photographed right in your own office.**

Turn the dial . . . get the clearest, fastest most convenient copy of anything. It's the new all electric Apeco Dial-A-Matic Auto-Stat with revolutionary finger tip dial control. It's light weight for easy portability . . . compact to fit on the corner of any desk and is styled in polished and satin finish stainless steel. It copies any original up to 15" wide, any length or color on opaque or transparent paper—printed on one or both sides. The Apeco Dial-A-Matic Auto-Stat offers hundreds of money and time saving uses at a price well within the budget of even the smallest firm.

The secret to the world's easiest copying method is in the dial. Amazing newly designed automatic copy control assures perfect copies every time. Just set the dial to the type of copies you want—your copies are ready in seconds.

***Delivered with Lifetime Service Guarantee***

## *Have You Read This NEW BOOK?*

**Mail This AIR MAIL**

***Postage Paid Card***

**For your *FREE BOOK***

**(See other side)**

**AMERICAN PHOTOCOPY EQUIPMENT CO.**
**Chicago 26, Ill.**

**American Photocopy Equipment Co.**
**1920 W. Peterson Avenue** (Dept. AW-96)
**Chicago 26, Ill.**

Rush me, without obligation, your free booklet on new Apeco Dial-A-Matic Auto-Stat copying. I understand this factual report will show me how I can improve the efficiency of my business as well as increase work output.

**PLEASE PRINT**

Company_____

Address_____

City_____ Zone____ State_____

Individual_____

Title_____

In Canada: Apeco of Canada, Ltd.
134 Park Lawn Rd., Toronto, Ont.

THIS CARD TEARS OUT
use it to get your
*FREE* BOOK

# New all-purpose copy maker

*the brand new*

APECO DIAL-A-MATIC *Auto-Stat*

*The Improved* **DIAL-A-MATIC** *for 1957*

**USED AND APPROVED BY THE AVIATION INDUSTRY**

## COPY ANYTHING AUTOMATICALLY

### *New FREE book tells how...*

Your free copy of this new booklet is packed with pictures and details about this revolutionary new copying method. Tells what Apeco Dial-A-Matic Auto-Stat copies are and how you can use these copies in your business. You, as well as every executive member of your staff, should read this worthwhile informative, factual report on this important new copy maker. You will find out how you can save time and money by speeding production, by cutting costly office paper work, by expediting shipping and receiving and hundreds of other ways to increase the efficiency of your business.

**FIRST CLASS**
Permit No. 26670
(Sec. 34.9 P.L.&R.)
Chicago 26, Ill.

**Via Air Mail**

**BUSINESS REPLY CARD**
No postage stamp necessary if mailed in the United States

**5c—Postage will be paid by—**

**AMERICAN PHOTOCOPY EQUIPMENT CO.**
**1920 W. Peterson Ave.**
**Chicago 26, Ill.**

**Use this tear-out postage paid air mail card**

**MAIL CARD TODAY**
**for Free Booklet**

plete wings. Because of this it is probable that bonding skills and facilities will have to be distributed through considerable portions of the factory area. Additional training in bonding techniques will be required.

Use of bonded sandwich construction with honeycomb or similar core material also will increase. This will increase the production load of the cleaning of the metal as a preparatory step, will mean more facilities and "more men with white gloves," Monesmith says.

Adhesive materials with greater heat-resistance will be introduced, raising curing temperatures and pressures.

### Tooling

Tooling will become more precise because of closer tolerances, hence more costly to build. More rigidity and precision will have to be put in stops, holding lugs, and locators to retain the part more accurately so that it can be machined to closer tolerances or assembled to closer fits, Monesmith says.

Aim will be to put more precision into the larger structural jigs. Closed-circuit television used in conjunction with optical tooling will enable the jig builder and inspector to have dimensional tolerances magnified for more exact observation.

With increased emphasis on surface smoothness, there will be more rigid requirements for accurate contour and elimination of steps and gaps. Also, as materials become harder, they will be less workable, more susceptible to fracture and stress corrosion if mishandled. Assembly fixtures will have to provide precise contour control and powered trimming features. Fit of parts will have to be assured before attachments are made.

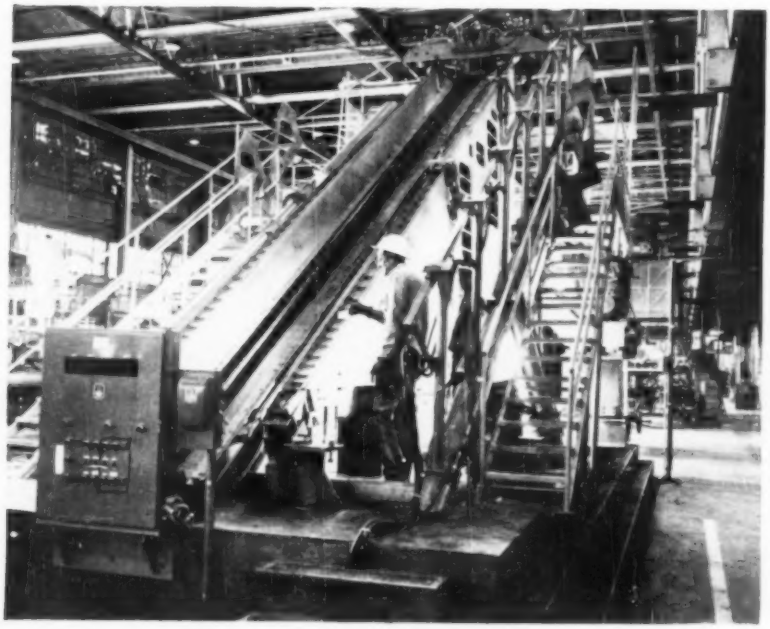
Increased emphasis on fatigue-resistance, fail-safe structure and weight reduction will affect configuration of parts and number and location of joints and splices. Splices will be parallel to direction of major loading rather than the most convenient direction for assembly. Longerons, stringers and skins will be tapered, will reach lengths up to 75 ft.

### Tape Controlled

Automatic riveting machines may be tape controlled, if production quantities warrant, Monesmith says. While this would speed assembly, it will involve new data processing skills. The riveting process may also provide for hot, high-velocity or high-frequency upsetting.

Hole preparation for riveted and bolted joints in the harder materials will require new approaches. Harder drill materials and different point configurations will be needed. Instead of drilling, high velocity punching of holes may be done in some cases.

For sealing faying surfaces, sealants will be used which add adhesive strength



## Eight Cuts on Two Wings

**VERSATILE BORING-MILLING MACHINE** developed by Convair California division of General Dynamics Corp. bores landing gear attachment trunion points on each side of two F-102A wings at a time, while other component simultaneously makes four cuts on top and bottom edge of leading edge skins on two wings.


There's more PULL built in Sensenich Propellers

New
FIXED PITCH METAL
CAA approved up to 165 hp.
FIXED PITCH WOOD
CAA approved up to 225 hp.
TEST CLUBS
up to 3000 hp.

Get all the facts...
write for Bulletins and Price Lists.
Dept. W, Sensenich Corp., Lancaster, Pa.

Sensenich PROP SHOP . . . Certified Repair Station for all makes fixed pitch metal or wood propellers . . . Sensenich, Beech and Hartzel controllables. Magnaflux, etching, anodizing and plating service available. Service Hangar on Lancaster Municipal Airport. Approved Propeller Repair Station 3528. Unlimited Class 1 and 2 ratings.

AIRCRAFT SENSENICH PROPELLERS
Serving the Aircraft Industry
for a Quarter of a Century

BIG or SMALL
they all SHINE BEST
SHINE LONGER
SHINE EASIER with
NEVR-DULL
Aluminum Cleaner and Polish

The original chemically-impregnated cotton wadding — Cleans quicker, gives higher, longer-lasting gloss, leaves protective film. Saves time, labor and money! Avoid inferior imitations.

AVAILABLE AT LEADING DISTRIBUTORS

MANUFACTURED EXCLUSIVELY BY
George BASCH Co.
559 Longfellow Avenue, New York 59, N. Y.

# Cessna T-37 designed for Jet Training

To meet jet age demands, the U. S. Air Force requires a jet trainer that makes it easy for cadet-pilots to master first-line combat airplanes.

The Cessna-developed T-37 introduces the cadet to all combat jet airplane characteristics while training on this safe, easy-to-fly jet trainer.

It is designed to provide the Air Force with a jet trainer that can be operated at substantial savings and cover the most important and longest phase of the cadet-pilot's jet training.

It is a privilege for us here at Cessna to team with the Air Force in its forward-thinking plans for the jet age. CESSNA AIRCRAFT COMPANY, Wichita, Kans.

Cessna®

*T-37 take-off, a safe, easy move into first-line jets for Air Force cadet-pilots.*

**Be an Aviation Cadet. Inquire today about the future your Air Force offers from your Air Force Recruiting Office.**

to the joint. These sealants will require curing at temperatures up to 200F. To increase fatigue life, many joints will be bonded and riveted even though sealing is not required.

In the future, emphasis will be more on the fabrication of pieces rather than assembly, Monesmith declares. This will apply to relatively small components (such as the F-104 wing) and to larger parts, as would be found in transport structures, which would be made as single pieces to minimize assembly operations.

### Metallurgy

The metallurgist will be more closely associated with quality control aspects of manufacturing because of new strength requirements for metals in future high performance aircraft.

One factor with which he will be concerned will be the trend toward higher heat treats.

Small errors in heat treatment will impair strength characteristics considerably, Monesmith said.

Other important considerations, he adds, will be the determination of the effect of various forming procedures on the integrity of the metal, and whether consistent results are being obtained in the elimination of surface residual stress with the shot peening process.

Subcontractors, too, will have to develop higher skills in keeping with the demands of new production techniques. This will be a natural progression as it has in the past, but involving various periods of familiarization.

New equipment also will have to be acquired by the subcontractor, the same as the prime contractor would have to get if it were doing the work in its own shop.

## Half-a-Million Pounds Of Beryllium Bought

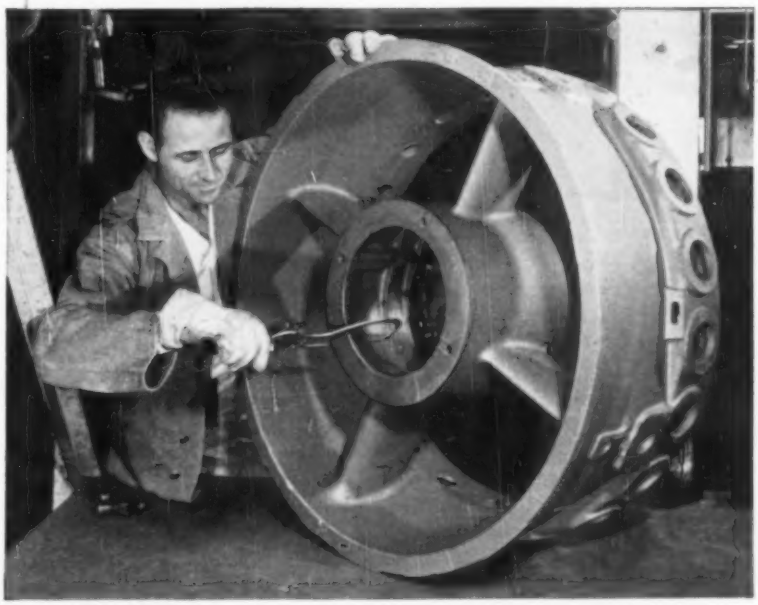
Half-a-million pounds of pure beryllium—a lightweight, nuclear reactor shielding material—have been bought for delivery over the next five years from the Beryllium Corp., Reading, Pa.

Beryllium has particular advantages in applications where high temperature is a factor and low weight a requirement. This is typical of aircraft reactors, as one example.

The metal is one of three materials commonly considered as moderators and reflectors in nuclear reactor design. The others are graphite and heavy water.

The metal has high resistance to corrosion and a high modulus of elasticity in addition to its light weight. It is used as a reflecting shield material; it bounces neutrons back into the reactor without absorbing them.


# QUALITY MAGNESIUM CASTINGS



A MAGNESIUM SAND CASTING at the Dow foundry. Many kinds of castings are produced—with quality standards to meet the special needs of the aircraft industry.

*. . . for the Aircraft Industry!*

**ORDINARY AND EXTRAORDINARY SAND CASTINGS**

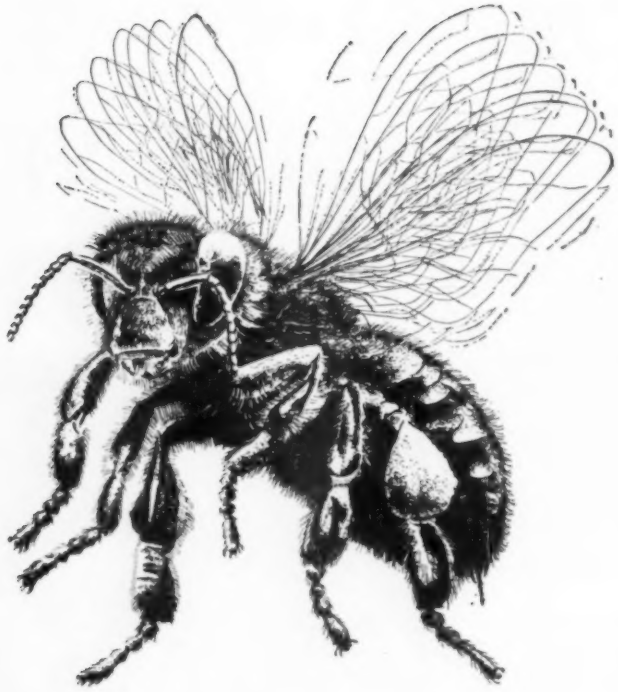
**PERMANENT MOLD CASTINGS**

**PLASTER CASTINGS**

YOU NAME THE CASTING, Dow can supply you with any shape or size required. Specialized inspection techniques rigidly maintain your standards and specifications. Heavy-wall or thin-wall, the best—and surest—answer to your problems are Dow magnesium castings! Contact your nearest Dow sales office for additional information.

**THE DOW CHEMICAL COMPANY**
**Foundry Sales, Bay City, Michigan**

DOW



# BUMBLEBEES CAN'T FLY!

You've heard the old story!

Rohr engineers, too, are busy every day solving near-impossible problems related to many phases of flight—important, challenging design and production problems on hundreds of vital, major aircraft components.

One example: The development and production of complex stainless-steel, honeycomb sections for high-speed aircraft and missiles.

Rohr is humming these days with more and more large military and commercial contracts.

Skilled engineers are urgently needed to grow with these big, long-range programs. Young men are offered outstanding career positions with unmatched opportunities for advancement within this large, fast-growing aircraft firm.

Especially needed now at Rohr are: *Design, Stress and Structures, Lofting, Equipment, Electrical, Liaison, and Aircraft Industrial Engineers, Thermodynamicists, Metallurgists.*

Write us today! Learn about our sound management policies, personal benefits, chances for quick advancement and other career advantages here at Rohr in beautiful Chula Vista located on cool San Diego Bay.

**Please write giving complete details and we will answer at once.**
**J. L. Hobel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 29**

**WORLD'S LARGEST PRODUCER OF** **READY-TO-INSTALL POW-R-PAX FOR AIRPLANES**

**ROHR**
**AIRCRAFT CORPORATION**

# Napier Spurs British Rocket Operations

First details on three new British rocket engines developed by D. Napier & Son Ltd. underscore Britain's increasing effort to produce rocket-powered operational aircraft and guided missiles.

Two of the engines, the NRE.11 and the NRE.17, are short-life units, specifically designed for guided missiles. The third, N.Sc.1 Scorpion, is a long-life powerplant designed for sustained firing.

All three types have been extensively flight-tested in aircraft and missiles.

### Scorpion Details

The Scorpion may be intended for one of the proposed next generation of RAF fighters, planned to be powered by a supersonic turbojet engine and auxiliary rockets. One such combination is the de Havilland Gyron Jr. turbojet and the DH Spectre.

A Scorpion installation was demonstrated at Farnborough this year as an auxiliary powerplant mounted at the rear of the bomb bay of an English Electric Canberra. First airborne firings were made in May this year and were followed by a series made over a wide range of altitudes.

### Other Rockets

First major production engine project was the NRE.11, a two-stage 2,000-lb. thrust unit operating on hydrogen peroxide and kerosene. The engine was capable of being stopped and re-started, and either thrust level could be selected during flight. Lower thrust rating has not been given, but the maximum value was in excess of 2,000 lb.

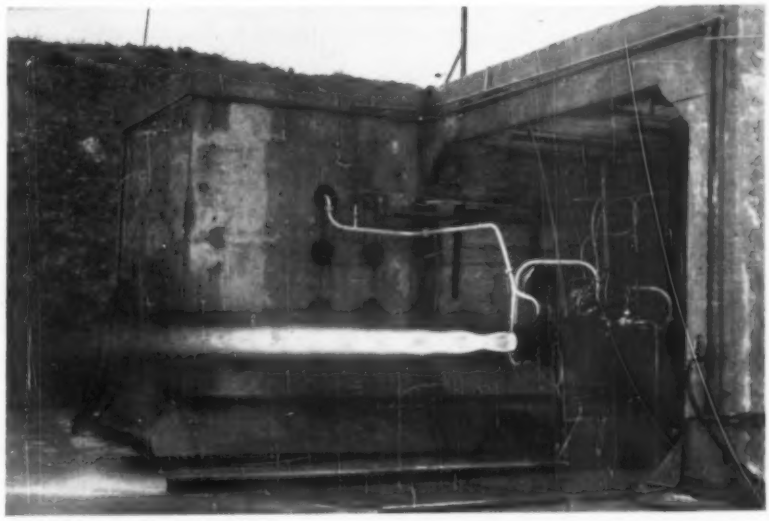
Production began on this unit in 1952, with deliveries slated for many of the experimental missiles and test vehicles of that time.

Further development of the powerplant resulted in the NRE.17, a similar rocket engine using the same bi-propellant combination. It uses uncooled combustion chamber and nozzle, which is a design simplification making for easier production. Napier says this unit can be produced in less than half the time of its predecessor NRE.11, and is lighter and more compact.

Thrust rating is presumably the same, at 2,000 lb.

Napier rocket work extends over the last six years. Several types of rockets have been developed and tested by the engineering teams at Napier's Flight Development Establishment, Luton. The rocket test installations there include facilities for proving out system and sub-system components as well as complete powerplants. One unique feature is an underground test bed where complete missiles can be run in before firings.

A major contribution to basic rocket engine design was made by the company in an extensive series of development tests on combustion chambers, cooling systems and burner head geometry. Research in parallel was conducted on auxiliary units, turbopumps and control valves.



**STATIC FIRING** of an experimental Napier rocket engine on a test stand at the company's test site at Luton shows the clean flame and clear shock diamonds characteristic of good combustion. Size indicates a thrust on order of 2,000 lb.

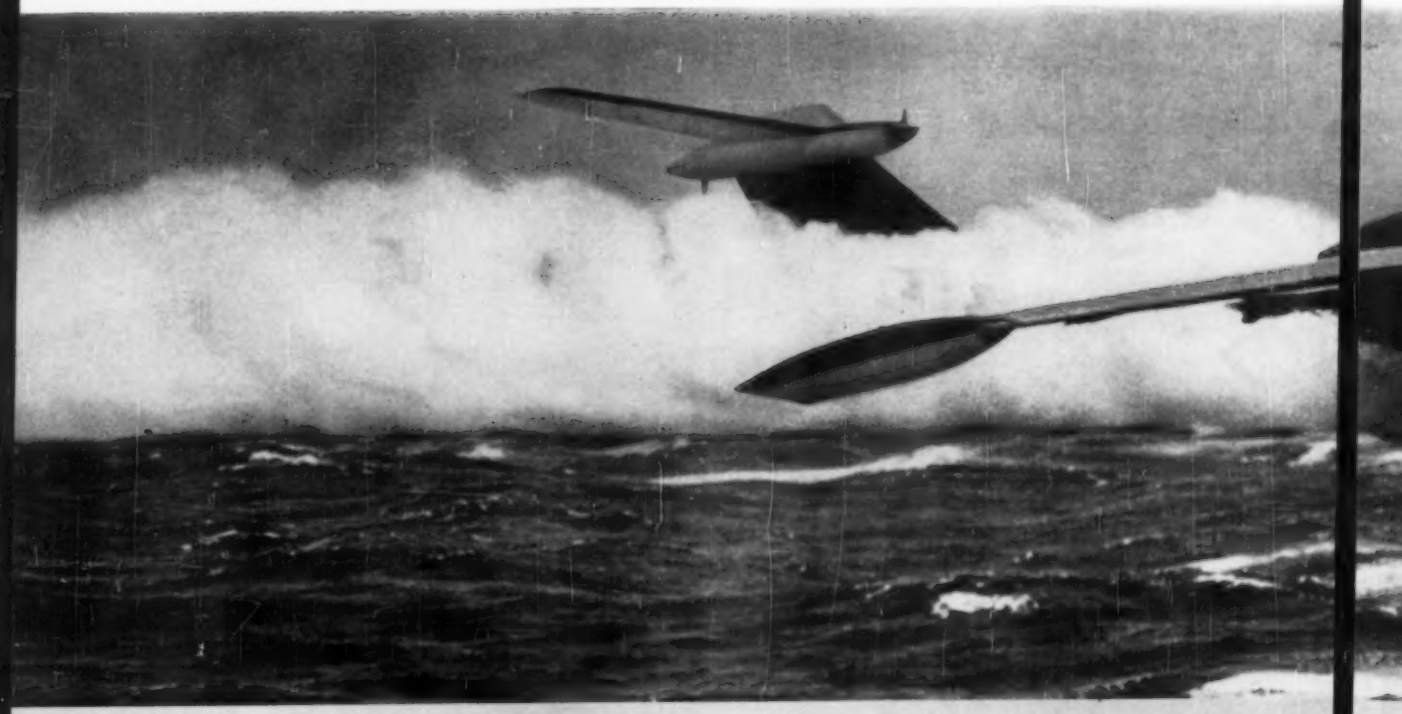
**NRE.11 ROCKET ENGINES** scheduled for shipment to the missile proving ground in Woomera, Australia, were first Napier production motors. These units are liquid-cooled, develop more than 2,000 lb. thrust maximum in two steps.

**NRE.17 ROCKET ENGINE** is a redesigned NRE.11, eliminating the cooling system because of advances made in uncooled combustion chamber and nozzle design. Contrast the compactness and cleanness of this engine with the earlier NRE.11.

## PRODUCTION BRIEFING

**Connecticut Hard Rubber Co.**, 407 East St., New Haven, Conn., will send samples of their new Kel-F elastomer coated fabrics to all who write in their application requirements. Kel-F, developed by the M. W. Kellogg Co., is claimed to resist swelling and deterioration in JP-4 and -5 fuels and Kel-F

# P6M



This is one of the most important and exciting aircraft in the world. It is the new Martin SeaMaster, the Navy's first multi-jet attack seaplane. It is now in production and soon to be in fleet service as the spearhead of a powerful new arm of the naval arsenal—the Seaplane Striking Force. The SeaMaster's importance is a matter of inevitability: It is in the over 600 *mph* class, with a normal cruise altitude of 40,000 feet, an unrefueled combat radius of 1,500 miles, and is operable in "Sea State 3" (waves averaging 6 feet) with a payload of 30,000 pounds. Thus, the endless runways of this world's oceans, lakes and estuaries provide unlimited and indestructible bases for SeaMaster operation, making it the first aircraft of any type having global striking power, independent of fixed installations. *For virtually the whole of our habitable world is within flight minutes of open water!* This new aircraft development is another powerful reason why the U. S. Navy offers to the military enlistee one of the most exciting futures in the world today.

**MARTIN**

BALTIMORE · DENVER

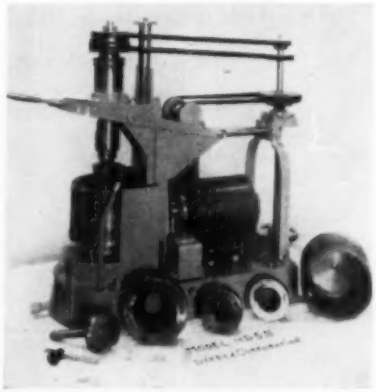
glass coated fabric will withstand 400F for extended periods.

**Gun blows** fine abrasive grit through stencils to etch inspectors' symbols on parts as they come off the line. Portable "airgrit" marker works on sheet glass, titanium, porcelain, stainless steel and plastics. It is made by Jas. H. Mathews & Co., 3721 Forbes St., Pittsburgh 13, Pa.

**Scully-Jones and Co.,** Chicago, pin-type arbor permits quick, easy placement and removal of splined bore gear blanks. The many pins seen sticking up from the arbor's shoulder engage the blank's splines and the assembly is locked in place when the work is given a turn causing the pins to ride up cams (inside the arbor) and jam into the spline slots. The Frank G. Hough Co., Libertyville, Ill., says that the new arbor has increased their production 10-15%.

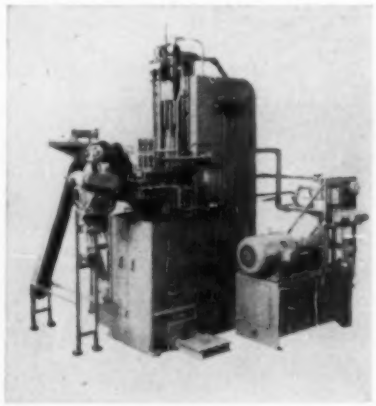
**Consolidated** Diesel Electric Corp.'s Canadian subsidiary, Consolidated Diesel Electric Corp. of Canada, has opened its headquarters at Rexdale, Toronto, Ontario. Con Diesel of Canada will manufacture ground support equipment for jet and rocket aircraft.

**Dykrex Corp. of America,** P. O. Box 9022, Northeast Sta., Newark 4, N. J.,



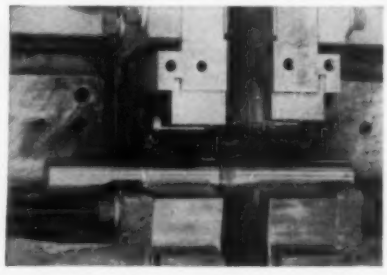
claims that its heavy duty ripping machine will finish wire dies up to 3" I.D.

**American Broach & Machine Co.,** Ann Arbor, Mich., broaching machine set up for automatic broaching of 300



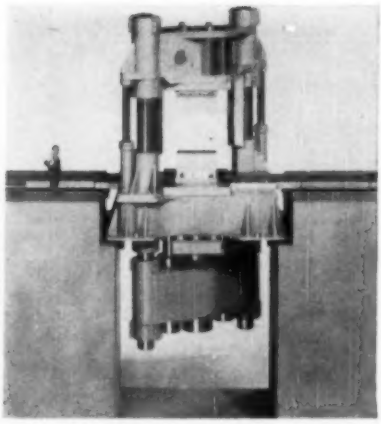
parts per hour. American Broach says they have designed this internal pull-down machine for maximum tooling flexibility.

**"Synchro-Shear"** welder, which trims the flash extrusion as it makes the weld, is being introduced by the Thom-



son Electric Welder Co., Lynn, Mass. Thomson reports that all sizes now handled by conventional flash welders can be handled by "Synchro-Shear."

**Two-thousand-ton** hydraulic forging press designed and manufactured by



Lake Erie Engineering Corp., Buffalo, N. Y., for Allegheny Ludlum Steel Corp., Dunkirk, N. Y. The single-action press makes 30 forging strokes per minute. The clearance is 48 in. by 90 in. with a 72 in. working stroke.

**Flightex Fabrics, Inc.,** New York City, has opened a new glass fabric finishing plant at Clifton, N. J. Bigelow-Sanford's Fiber Glass Division has relocated its sales offices from New York City to Amsterdam, N. Y.

## Australian Sea Venom Grounding Modified

**Melbourne**—Royal Australian Navy has conditionally revoked the grounding order for its de Havilland 38 Sea Venom jet fighters of its newest aircraft carrier HMS Melbourne (AW Sept. 3, p. 34).

Tests at the Nowra Naval Air Station of the Royal Australian Navy had revealed no serious mechanical defects, but the resumption of full flying duties is conditional on a forthcoming series of land-based takeoffs and landings to prove the complete airworthiness of the fighters.

Further investigation will be ordered if tests do not prove satisfactory.

## New Upholstery Material For Use in Helicopters

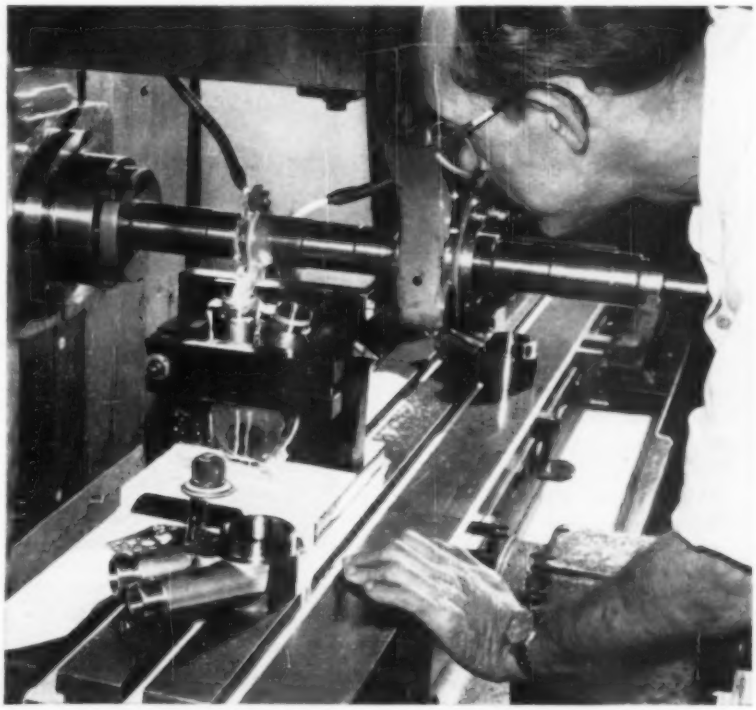
Trilok, a new, three-dimensional upholstery material recently put on the market by United States Rubber, is being used extensively on New York Airways 12-passenger S-58 helicopter (AW Aug. 13, p. 43).

The material is used on the seats, where its three-dimensional quality allows air circulation between the person and the seat. It is also used on the cabin walls, ceiling, and hat rack because of its lightness in weight, soundproofing qualities and cushioning ability.

The material, made of conventional fibers and polyethylene yarn, is durable and easy to clean, the company said.


**MALLORY·SHARON reports on**

# TITANIUM



*Now—machine titanium alloys in "soft" condition . . .*

**HEAT TREAT TO HIGH STRENGTHS**

• New heat-treatable titanium alloys can be machined and formed readily, yet offer exceptionally high heat treated strengths in final form.

For example, Mallory-Sharon's MST-6A1-4V titanium alloy is available in the annealed condition with typical ultimate tensile strengths of 140,000 psi. Here machineability is comparable to that of stainless steel. After machining, parts can be heat treated to typical ultimate tensile strength of 185,000 psi.

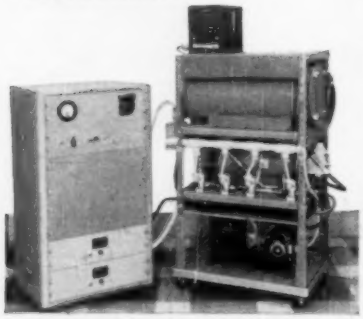
This is another example of the rapid development of titanium —in which Mallory-Sharon has played a leading role. Call us for the full range of titanium and titanium alloy mill products, and for engineering assistance.

MALLORY-SHARON TITANIUM CORPORATION, NILES, OHIO

MALLORY Ti SHARON

**DYNAMIC ALTITUDE SIMULATOR**

**FOR TEST AND EVALUATION OF FLIGHT CONTROL EQUIPMENT AND INSTRUMENTS**



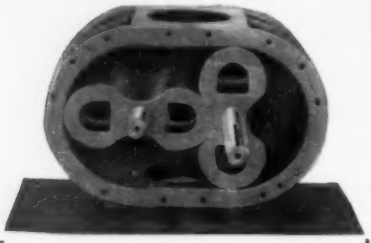
**Simulates actual altitude conditions of high performance aircraft or missiles in flight**

Range — minus 1,000 to 80,000 ft
Max rate — 50,000 ft/min
Max response 10 cps

*Write for Brochure*

**COLOR TELEVISION INCORPORATED**
**SAN CARLOS 6, CALIFORNIA**

Visit Booth No. 38—NEC Show Chicago



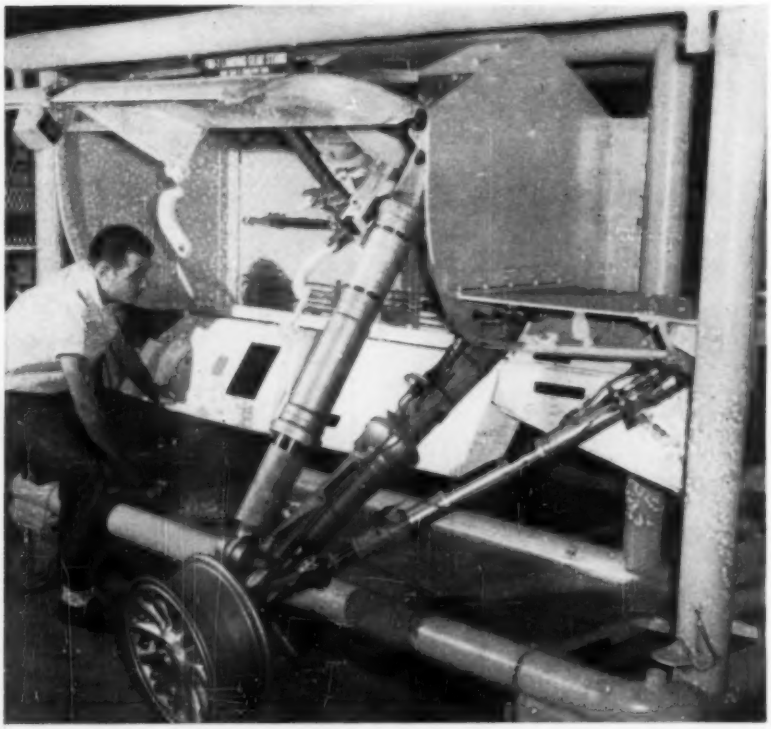
**"Get Your Air the Positive Way"**

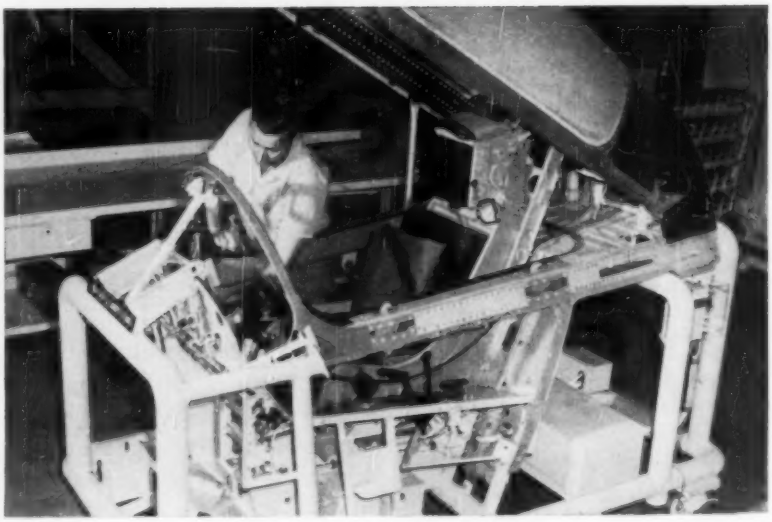
*USED BY*
**THE AIRCRAFT INDUSTRY FOR:**

- **Jet Engine Starters**
- **Cabin Pressurization**
- **Simulated Altitude Conditions**
- **Ground Air Conditioners**

**SUTORBILT**

**CORPORATION**
**2008 East Slauson Avenue**
**Los Angeles 58, Calif.**
**Main Plant: LUdlow 7-2228**
**Sales Office: LOgan 8-2226**

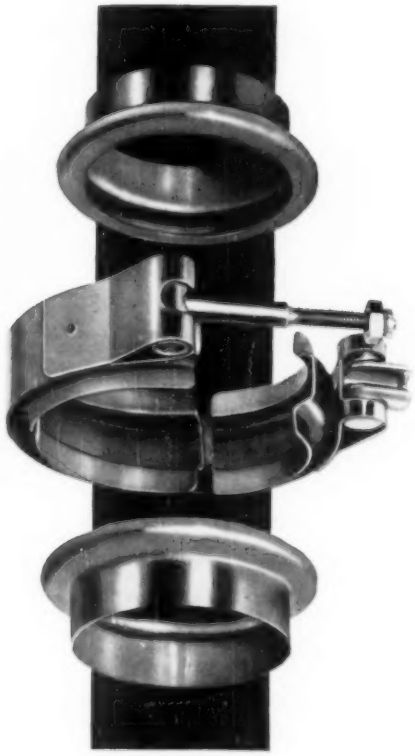




## Maintenance Trainer

Chance Vought maintenance trainer built to teach Navy men inner workings of F8U-1 Crusader. Device resembles parts of dissected airplane mounted in welded iron frames on casters. First trainer was sent to Naval Air Technical Training Command at Memphis, another is planned for Pacific Fleet later in year. Several trailer trucks were required to carry 14-unit trainer; largest unit is three-section surface controls section measuring 23 ft. in length. Wherever possible units are made from actual parts of F8U so personnel can more readily visualize airplane. Parts include whole cockpit, electrical system, landing gear and arresting gear, fuel system and engine controls, air conditioning system, wing fold, variable incidence wing and leading edge droop, speed brake and rocket pack, hydraulic power system, electrical power system. Fuel system and engine control stand include engine indicating systems so that starts, engine runs and shutdowns show on panel. Each of various units has provision for instructors to introduce "trouble." Top picture shows landing gear and arresting hook unit, bottom, cockpit section.

# Martin selected . . .



. . . Janitrol air couplings for the Navy's new P6M-1 SeaMaster, saving 75 pounds in coupling weight over the "X" version. Each SeaMaster attack seaplane uses Janitrol high-pressure, high-temperature couplings on bleed air ductwork . . . for many reasons beyond the weight reduction alone.

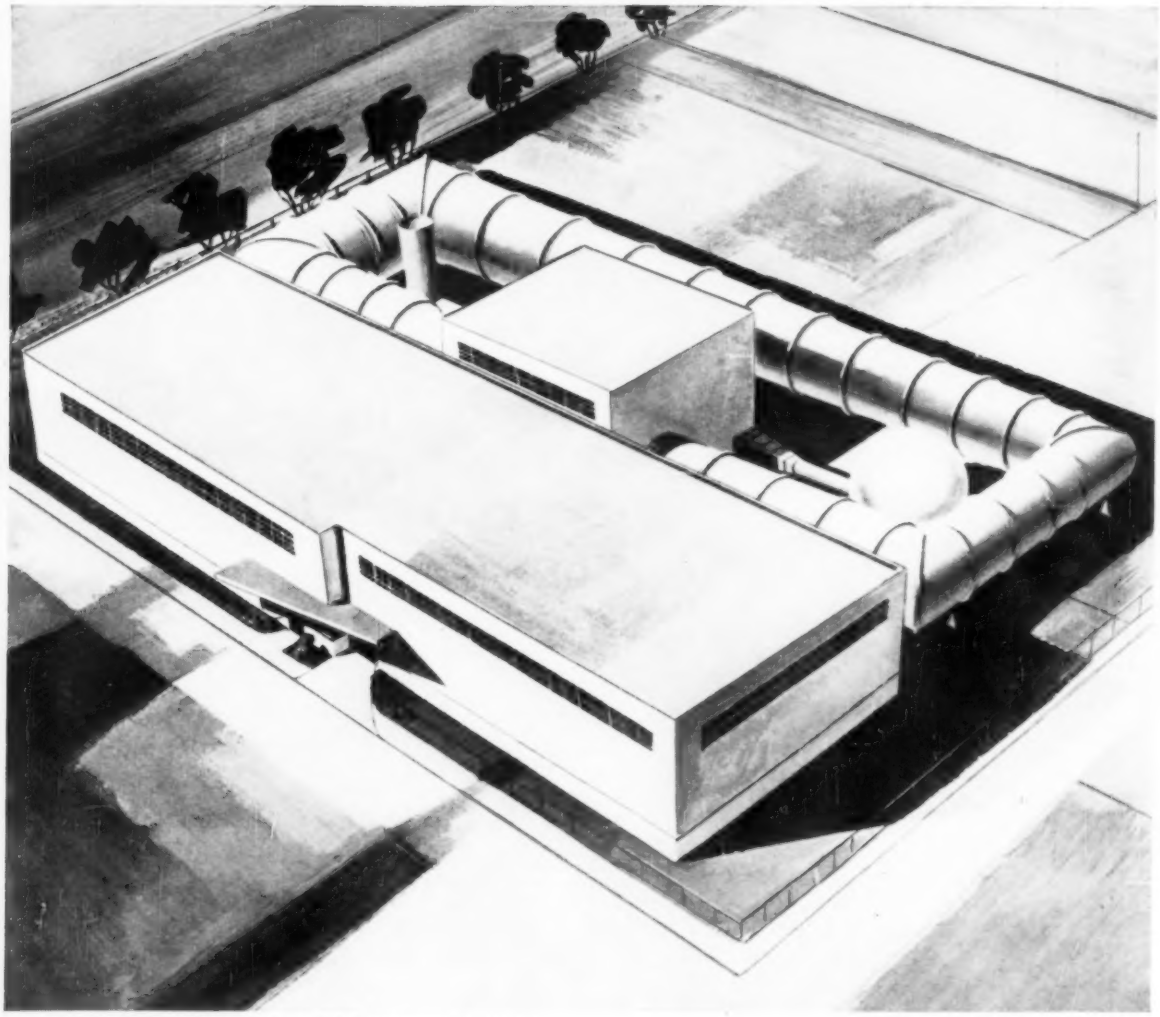
Couplings seal with metal-to-metal contact . . . no secondary sealing devices or compounds are needed. They're designed for continuous use at 250 psi—750° F—and can be connected and disconnected easily as often as necessary with practically no change in leakage rate. Maximum design leakage: .01 cfm per inch of duct diameter. In addition, the couplings withstand adverse conditions—corrosion, temperatures, pressures, surges, vibration, and misalignment.

Fifteen sizes available now. Write for technical information, or call your nearest Janitrol representative.

Janitrol Aircraft-Automotive Division, Surface Combustion Corporation, Columbus 16, Ohio . . . District Engineering Offices: Washington, D. C., Philadelphia, Columbus, Ft. Worth, Hollywood.

COMBUSTION SYSTEMS · HEAT EXCHANGERS · PNEUMATIC CONTROLS

Janitrol®



This wind tunnel will permit studies of aircraft flight reactions up to Mach 4.

# What's in the wind for engineers?

The answers to subsonic and supersonic problems that may be on your mind right now may very well be studied in this modern Engineering Department wind tunnel soon to be in operation at North American's Columbus Division. This is a major piece of new equipment for this continually expanding department, already one of the finest facilities for research and development in the industry.

The tunnel will handle airflow studies from deck-landing speeds to Mach 4. With it, engineers will test a multitude of ideas and variables in the fields of Aerodynamics, Thermodynamics and Dynamics.

The Engineering Department has sixteen complete laboratories for creative engineers to test, study and evaluate their ideas. The individual and his ideas are important in this completely integrated, growing organization, which holds prime responsibility on all North American's aircraft projects for the Navy—from concept through flight.

You can share the achievements and rewards that come from initiative backed by well-handled resources. This is a place where men who get results—get results!

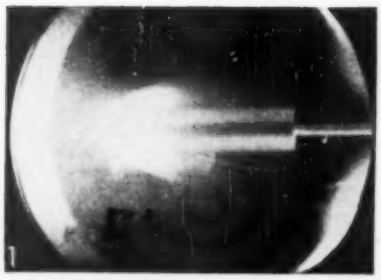
**OPENINGS FOR GOOD MEN IN ALL THESE FIELDS:**

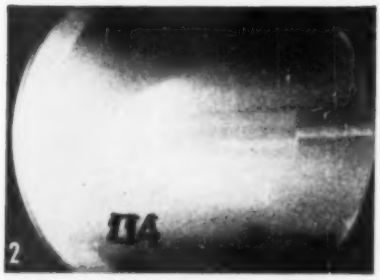
Aerodynamicists, Thermodynamicists, Dynamicists, Stress Engineers, Structural Test Engineers, Flight Test Engineers, Mechanical and Structural Designers, Electrical and Electronic Engineers, Wind Tunnel Model Designers and Builders, Power Plant Engineers, Research and Development Engineers, Weight Engineers.

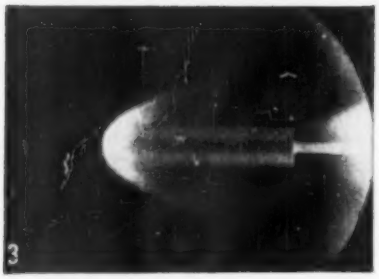
For your career's sake, you should know the facts. Write: Mr. J. H. Papin, Personnel Manager, Dept. 569AW, North American's Columbus Division, Columbus 16, Ohio.

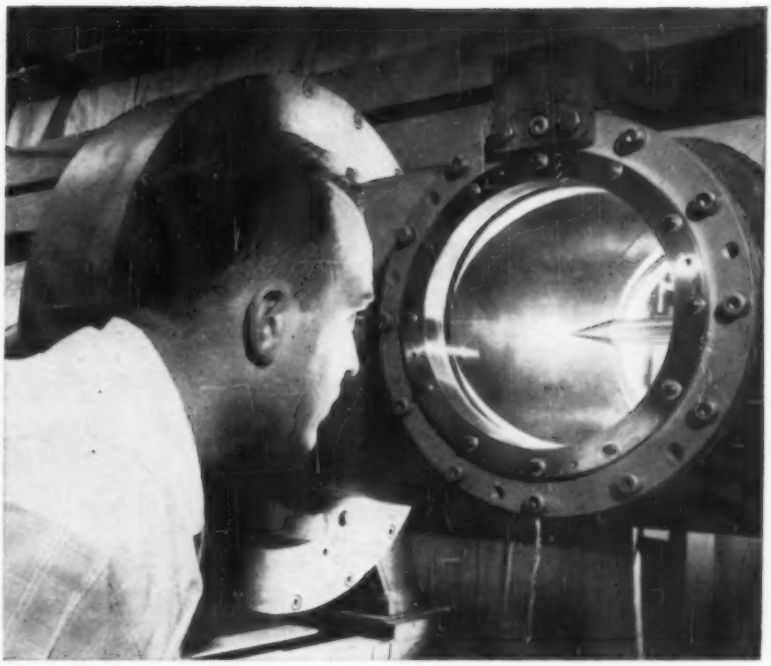
**THE COLUMBUS DIVISION OF**

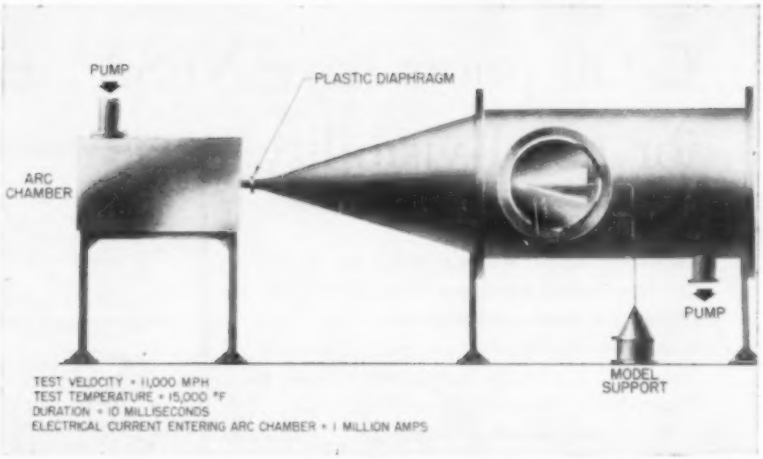
**NORTH AMERICAN AVIATION, INC.**












# Hot Shot Wind Tunnel Hits Mach 15

First pictures of Arnold Engineering Development Center's Mach 15 Hot Shot wind tunnel show typical run and layout of the new USAF test facility at Tullahoma, Tenn., (AW Sept. 17, p. 33). Hot Shot uses the discharge of a roomful of capacitors across an air chamber to burst a diaphragm and send a relatively long duration hypersonic blast past a small model.

The strip of high speed motion picture frames (7,000 per sec.) down the left column stops the model's response to the 10 millisecond blast. The airflow starts past the model's rounded nose in the first frame; comes to peak velocity of 11,000 mph., which produces 15,000F in the shock envelope in the second frame; begins to lose speed and luminosity in the third; and ends with the nose of the model still glowing in the fourth.

The researcher in the upper right hand picture is looking at another model (with pointed cone shape nose) in the 16. in. test section.

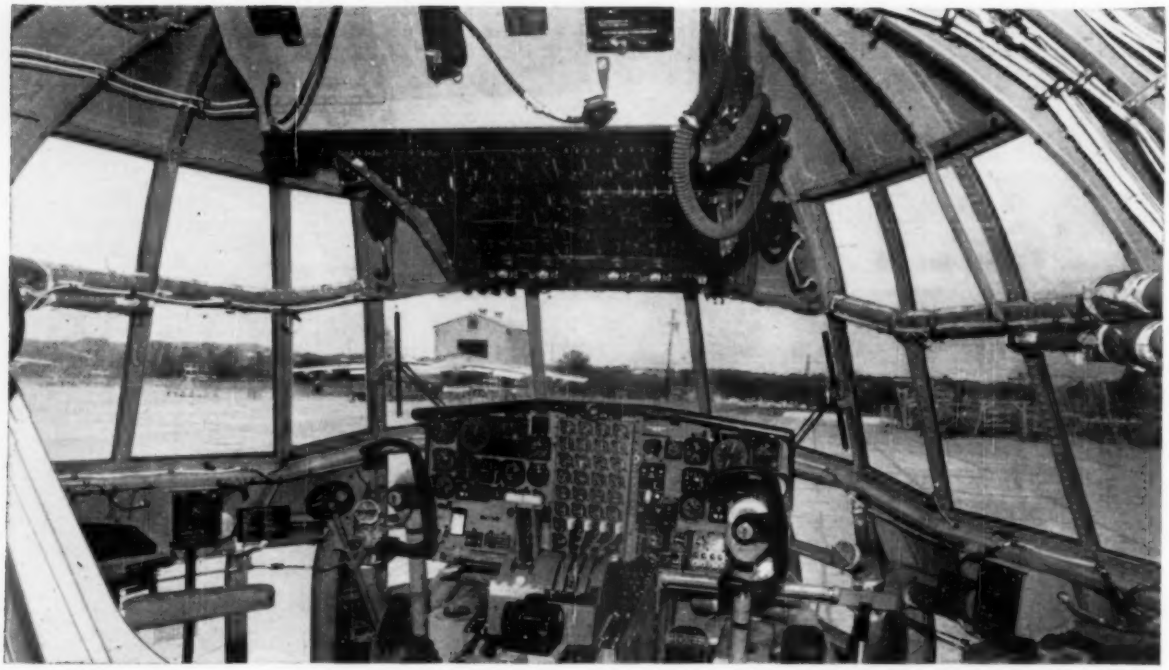
The bottom drawing shows the layout of Hot Shot. (Actually the expansion angle of the cone is about half that which the artist has shown.) The pumps charge and evacuate air on the two sides of the diaphragm.

Not shown are the banks of capacitors which release their charge across the arc chamber.

Arnold engineers relate that the electrical discharge actually melts away portions of the tunnel ducting and bits of glowing molten metal strike the model during the latter phases of the airflow. However, they claim this contamination develops later than it normally does in shock-tube types of hypersonic tunnels and is preceded by a longer, more uniform flow in which valid test data can be recorded.

The hypersonic facility is being used to explore possible methods for cooling the surface of missiles and aircraft as they encounter speeds which are well up on the slope of the thermal barrier.

The tunnel was designed and built by ARO, Inc., the operating contractor for the Tenn. ARDC/USAF center.



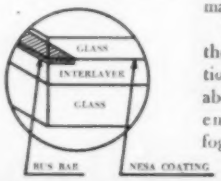
# C-130 pilots have NESA® windshields for good visibility

Lockheed's C-130 Hercules is the Air Force's first turbo-prop transport. It is built to fly higher and faster *or* lower and slower (and more economically) than any existing military transport. The cargo compartment is much larger than a standard railroad freight car. It will carry about 20 tons of cargo.

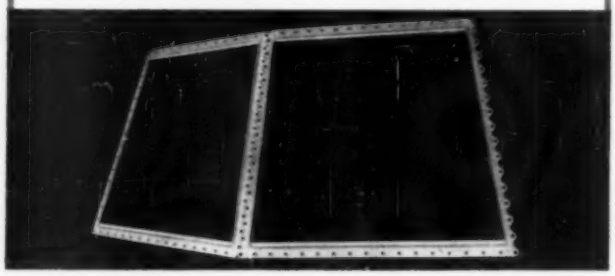
This is truly a workhorse airplane—and it must be ready to fly in all sorts of weather. NESA Flexseal® electrically heated windshields were selected to protect the pilot against the hazards of icing and fogging. Tolerances are so close that windshields are directly interchangeable between different fuselages.

Our Technical Representative will be glad to discuss difficult aircraft glazing problems with you. Just write to Pittsburgh Plate Glass Company, Room 6391, 632 Fort Duquesne Boulevard, Pittsburgh 22, Pa.

*This is NESA.* NESA is a transparent, electrically conductive coating applied to hot glass as it comes from the furnace. Electrical energy is delivered to the NESA surface by fired-on bus bars located on opposite edges of the glass. A laminate with NESA usually contains a sealed-in temperature sensing element to prevent overheating of the interlayer material.




Sufficient voltage is applied between the bus bars to provide heat dissipation to a typical NESA windshield of about 2100 BTU/hr/sq. ft., usually enough to melt ice and prevent fogging.



PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS · FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

# Vortac Catches Industry Off Balance

By Philip J. Klass

Distance measuring equipment (DME) for the newly adopted Vortac civil navigation system is slated to become available from one avionics manufacturer late next year and at least two other suppliers hope to have Tacan-compatible (clear-channel) DME available by late 1958 or early 1959.

However, the Air Coordinating Committee's recent clear-cut decision, following two uncertain years in which the prospects of civil DME and competitive Tacan alternately blew hot and cold, has caught most avionics manufacturers off balance, an AVIATION WEEK spot check shows.

Federal Telecommunications Laboratory, which developed Tacan, is moving rapidly to exploit its know-how with the hope of crashing the airline/business aircraft market. FTL expects to flight test a prototype Vortac DME within three months. The unit, which weighs about 30 lb. and is housed in a one-half ATR size case, will provide distance (only) information when operating with either a military Tacan ground station or a civil version which the Civil Aeronautics Administration will install at present VOR (omnirange) stations.

In airline fleet-size quantities, the FTL set is expected to sell for around $5,000, with initial production available by late 1957, a spokesman told AVIATION WEEK. By adding another one-fourth ATR size unit, weighing about 15 pounds and costing around $1,000, both Tacan bearing and distance information can be provided.

Other avionics manufacturers have not yet established firm plans or timetables, AVIATION WEEK's spot check reveals:

• **Bendix Radio** expects to have Vortac DME equipment available by 1958-59 to meet airline jet aircraft needs, a spokesman says. Bendix, which previously marketed a civil DME built by Hazeltine, expects to develop its own Vortac DME.

• **Collins Radio** says it can have a Vortac DME available by late 1958 or early 1959 providing the airlines are willing to accept a three-quarter ATR size unit instead of the one-half ATR case called for in the Aeronautical Radio Inc. specification for civil DME. Collins says the DME can squeeze into a one-half ATR case, but this will delay equipment availability by 8 to 12 months. More important, Collins believes that the reliability of the Vortac DME will suffer if squeezed into a one-half ATR size case because of heat dissipation problems resulting from such high density construction.

(Collins originally objected to the one-half ATR size specified in the old Arinc civil DME spec, based on its extensive experienced in developing a ruggedized military Tacan receiver for the Navy. Some of Tacan's early reliability problems reportedly stemmed from overheating due to its high density construction. The one-half ATR squeeze is made more difficult by airline reluctance to use sub-miniature tubes, Collins says. However, FTL says it has developed new simplified circuits which in combination with use of silicon diodes will enable it to meet the one-half ATR requirement.)

• **Narco (National Aeronautical Corp.)**, whose civil DME has been obsoleted by the recent ACC decision, is waiting for the dust to settle. At ACC's request, to aid in its Vortac deliberations, Narco furnished its best estimate of the selling price (with normal distribution mark-up) for minimum standard (private flyer) Tacan equipment, comparable in design-manufacturing techniques to its popular Omnigator. On this basis Narco estimated that it could market a Vortac DME (distance only) for about $3,100, or a complete distance-bearing Tacan set for about $4,100. A Narco spokesman says the company's policy is to maintain its position as a supplier of a line of avionics equipment, but that any new Vortac DME development will probably have to take its place behind the firm's present work load.

• **Stromberg-Carlson Co.**, which together with Hoffman Electronics Co.

## AVIONIC INDUSTRY SALES, EARNINGS UP

| Company | Period | Sales | Change From 1955 | 1956 Profits (After Taxes) | Change From 1955 | Earnings Per Common Share* | Change From 1955 |
|---|---|---|---|---|---|---|---|
| Amphenol | 6 mo. | $13,909,556 | +25% | $626,446 | +41% | $1.56 | +40% |
| Consolidated Electrodynamic Corp | 6 mo. | 10,806,128 | +32% | 568,147 | +92% | 0.60 | +94% |
| Hoffman Electronics | 6 mo. | 22,875,561 | +31% | 783,972 | +87% | 1.07 | +87% |
| Litton Industries | 12 mo. | 15,000,000** | +70% | 900,000 | +100% | 0.90 | ..... |
| Radio Corp of America | 6 mo. | 526,488,000 | +8% | 20,037,000 | −10% | 1.32 | −10% |
| Servo Corp | 6 mo. | 1,612,100 | −29% | 110,000 | −32% | 0.21 | *** |
| Servomechanisms | 6 mo. | 7,264,473 | +17% | 307,447 | +35% | 0.40 | +33% |
| Texas Instruments | 6 mo. | 19,289,917 | +48% | 1,029,847 | +48% | 0.15 | +66% |

* After provision for preferred stock, if any.
** Fiscal year ending 7/31/56.
*** Not comparable because of new issue when stock was listed on American Exchange, Oct. 1955.

# *You'll want to evaluate...*

...the new Stewart-Warner Electronics ATC Radar Safety Beacon on your own test bench.

Every Airlines Electronics Engineer who has seen the new airborne beacon is making plans to dig into this clean box on his own test bench. There will soon be a limited few units available for your evaluation study.

We want you to see for yourself how this equipment, specifically designed to ARINC characteristic No. 532-A, combines all the reliability and long-life factors of airborne radar equipment manufactured by Stewart-Warner Electronics for the past 15 years.

STEWART SW WARNER ELECTRONICS

*a Division of Stewart-Warner Corporation*

## MOST ADVANCED DESIGN AVAILABLE

Stewart-Warner transponder experience has enabled us to evaluate possible future modifications in this type equipment. As a result, the design is flexible enough to accommodate all AEEC "Green Sheet" expansions; for example, side lobe suppression and other foreseeable requirements such as:

1. By internal switching we can provide a second pulse train spaced 4.35 microseconds after the last pulse of the first train.
2. The delay line is tapped every 1.45 microseconds to provide for future expansion of the coding system. For example, automatic air-to-ground flight data transmission.
3. Facilities have been provided to include two additional interrogation modes upon customer request.

Write today for latest details and availability of evaluation units. Stewart-Warner Electronics, Civil Aviation Dept. 14, 1300 No. Kostner Ave., Chicago 51, Ill.

## Progress

The recent Air Coordinating Committee Vortac compromise ending several years of bitter controversy between civil VOR-DME and the military Tacan system, is the same plan originally proposed by the Defense Department more than three years ago to get around the frequency conflict between civil DME and Tacan.

Aviation Week's article (Dec. 7, 1953, p. 40) which first revealed the existence of the controversy reported: "The military are believed to have proposed that CAA change or convert its present DME station to the new military (Tacan) system. If this were done and new civil airborne DME were designed for the military system, these units would get only distance information when they interrogated the converted CAA ground stations.

"Military aircraft, equipped with the full Tacan unit, would get both distance and bearing information. Civil aircraft would continue to use VORs (omniranges) to get bearing indications."

is a second source producer of military Tacan receivers, is on the fence as to whether it should try to crash the airline DME market, a spokesman says. Lacking airline marketing-servicing experience, Stromberg-Carlson might consider an arrangement with an established airline avionics supplier, much like the one which Hazeltine worked out with Bendix Radio.

### Specifications Needed

Except for FTL, potential Vortac DME manufacturers are waiting for the Air Navigation Development Board to come up with Common System technical characteristics for the new DME. Under ANDB sponsorship, Airborne Instruments Laboratory (which did much of the investigative work in the Vortac controversy) has drafted a proposed specification. ANDB is currently working to convert this draft into firm specs, which ANDB Director D. K. Martin hopes will be ready within 60 days.

Another detail which must be worked out is the pairing of Vortac DME frequencies with VOR and ILS frequencies so that pilot selection of the desired VOR station frequency will automatically tune in its corresponding DME frequency. ANDB has given this problem to the National Bureau of Standards which earlier conducted extensive Tacan frequency allocation studies in connection with resolving the Tacan/DME hassle. Martin expects the frequency pairing specs to be worked out without difficulty also within 60 days.

Arinc's Airline Electronic Engineering Committee (AEEC) is going to work to revise its old civil DME characteristic. Initial emphasis will be given to case size, indicator type, and interconnecting wiring, because such information is needed immediately by jetliner manufacturers. Arinc hopes that the Vortac DME can use the same interconnecting wiring and case sizes as the old civil DME to avoid changes in jetliner designs, according to William Carnes, manager of electronic engineering.

### Indicator Type

One likely change is in the type of DME cockpit indicator. The original Arinc spec permitted the use of a voltmeter-type of distance indicator in order to accomodate the existing Narco DME design. However, Carnes believes that the digital counter type indicator is preferable, to avoid degrading the accuracy of distance information available from Vortac DME.

Arinc hopes to get out its preliminary DME characteristic, dealing with form factor and wiring, within 30 days. This will be followed later by a more complete characteristic spelling out the detailed equipment performance specifications. However, Carnes points out that Arinc has several other high-priority characteristics in process, including single sideband, air traffic control signal-


FIRST . . . LOOK FOR THE REAL

**OPPORTUNITIES**

BEECHCRAFT is aggressively entering new fields and needs men of imagination to do creative work of top-level importance. BEECHCRAFT is now seeking

**SCIENTISTS**
**PHYSICISTS**
**ENGINEERS**

If you would like to be associated with a leading organization that is large enough to have diversification of product, but small enough to insure recognition of personal ability – for work now going on, and work now being planned for Beechcraft's Boulder, Colorado, special engineering facility, as well as Beechcraft's main plants in Kansas, write today to

The Employment Division

Beechcraft

WICHITA 1, KANSAS

BILL WHITESIDES—
*Engineering Manager*
*Flight Refueling, Inc.*
Baltimore, Maryland

Graduate of Texas Tech with 18 years' experience in power plant and fuel transfer design.

BILL WHITESIDES' ENGINEERING STAFF NEEDS:

**DESIGN ENGINEERS**

1 to 3 YEARS' EXPERIENCE

Just the spot for you . . .

- If you're ready to make a change
- If you're lost in a large organization
- If you're interested in new career opportunities

**Bill needs young men with ideas NOW to join his hard-hitting team of aerial fueling specialists.**

•

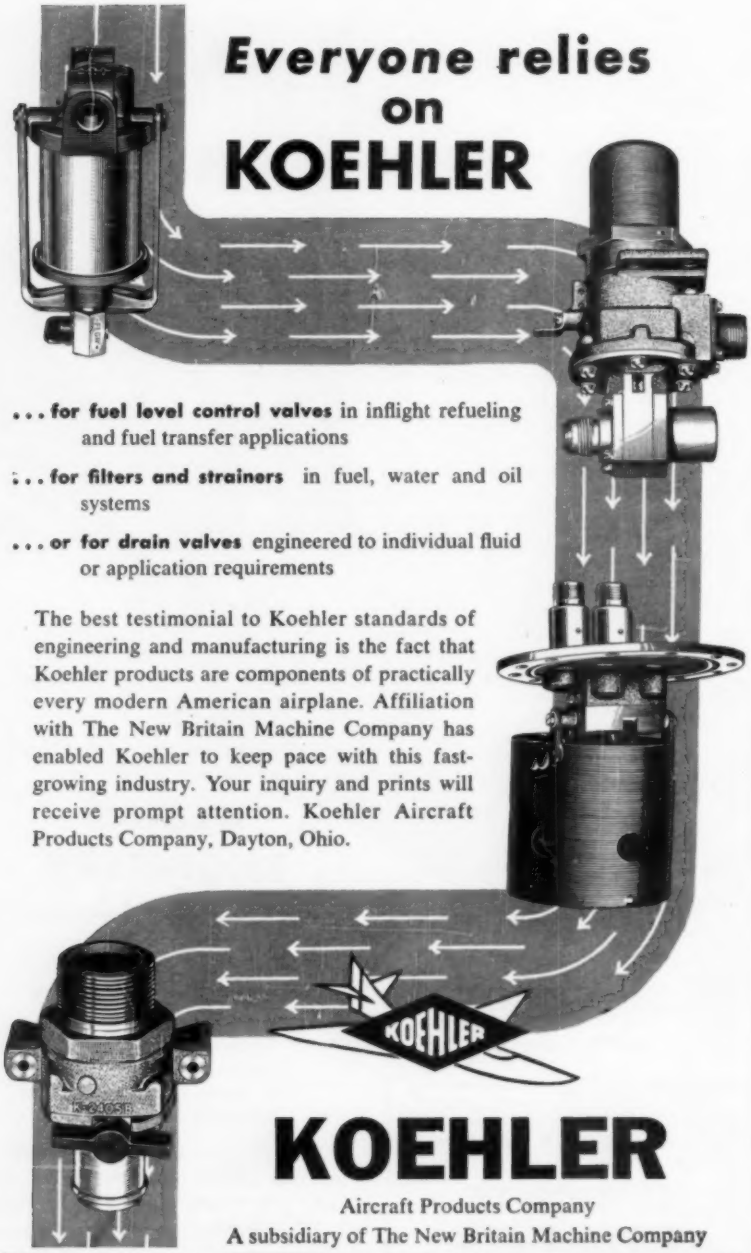
Ideal working conditions and close proximity to modern communities bordering on Chesapeake Bay and the Severen and Magothy Rivers. Excellent universities nearby for advanced study.

Send resume to

BILL WHITESIDES

*Flight Refueling, Inc.*

FRIENDSHIP AIRPORT
Baltimore 3, Maryland



**Everyone relies on KOEHLER**

**. . . for fuel level control valves** in inflight refueling and fuel transfer applications

**. . . for filters and strainers** in fuel, water and oil systems

**. . . or for drain valves** engineered to individual fluid or application requirements

The best testimonial to Koehler standards of engineering and manufacturing is the fact that Koehler products are components of practically every modern American airplane. Affiliation with The New Britain Machine Company has enabled Koehler to keep pace with this fast-growing industry. Your inquiry and prints will receive prompt attention. Koehler Aircraft Products Company, Dayton, Ohio.

**KOEHLER**

Aircraft Products Company

A subsidiary of The New Britain Machine Company

**AIRCRAFT TUBING**

GOVERNMENT SPECIFICATION TUBING IN STOCK..

| 4130 GRADE | | 4135 GRADE | 1025 GRADE |
|---|---|---|---|
| • AMS - 6371 | • AN-T-69 | • AMS - 6372 | • MIL-T-5066 |
| • MIL-T-6736 | • AN-WW-TB50a | • MIL-T-6735 | • AN-WW-T846 |

**SERVICE STEEL** • DETROIT, MICHIGAN LOS ANGELES, CALIFORNIA


ling system (ATCSS) and self-contained navigation aids.

### CAA Plans

The recent ACC Vortac decision has dumped a sizable work load on the CAA, already burdened by its expanded traffic control program. In order to meet the ACC requirement that Vortac DME facilities for high altitude en-route and terminal operations be operational by July 1, 1959, the CAA may be forced to modify some of its practices in the procurement of initial civil Tacan ground station equipment, a spokesman says.

To meet the ACC deadline, CAA may buy a limited number of modified military URN-3 Tacan ground stations—modified to include dual equipment with automatic switchover in event of failure.

Subsequent procurements would then be made in accordance with usual CAA specifications.

### Combined Station

CAA currently is investigating the problem of co-location of VOR and Tacan ground stations at Phillipsburg, Pa., using techniques devised by Rome Air Development Center. A combined VOR-Tacan station requires a larger building to house the equipment, a larger VOR counter-poise, and additional power.

The Phillipsburg investigation will provide the CAA with information on the cost and time involved in the Vortac conversion, enabling it to plan its timetable. It may also suggest ways to telescope the conversion to minimize down-time.

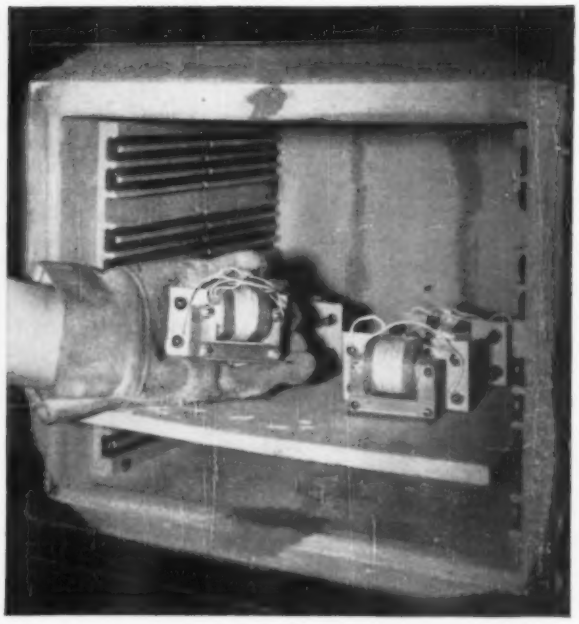
After several disturbing years of uncertainty, the ACC decision has clearly unleashed the industry's energies for a much-needed attack on pressing traffic control problems.

## Westinghouse Makes Cheaper Rate Gyro

**Pittsburgh**—Westinghouse Electric Corp. has disclosed a cheaper, more sensitive rate gyro designed around the vibrating mass principle. This is the principle used by the common housefly to sense flight stability.

Called Vibragyro, the Westinghouse device is expected to cost only a fifth of what present rate gyros cost. First model is expected to have a sensitivity of from .05 deg. per sec. to 300 deg. per sec. Essentially, Vibragyro uses the output of two vibrating masses to give a frequency signal on another axis.

(A similar vibrating-mass type of gyro, developed by Sperry-Gyroscope Division of Sperry-Rand Corp., was described in detail by AVIATION WEEK in its November 23, 1953 issue, p. 57.)

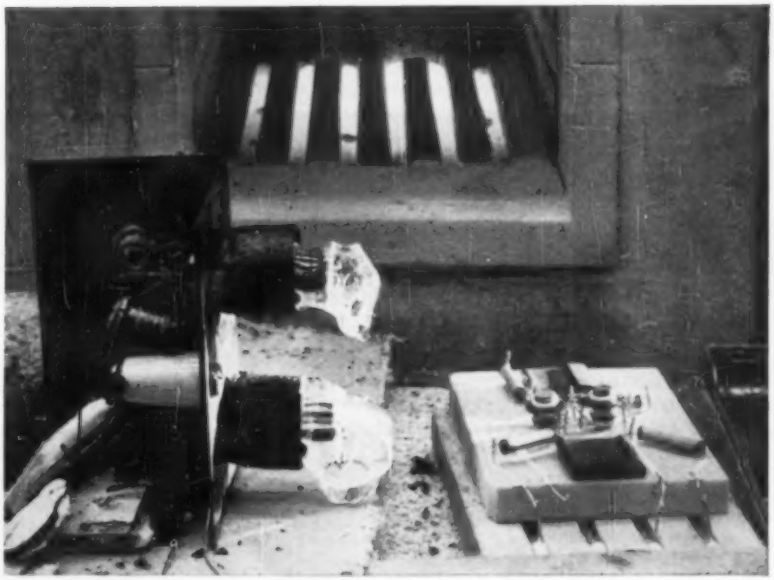


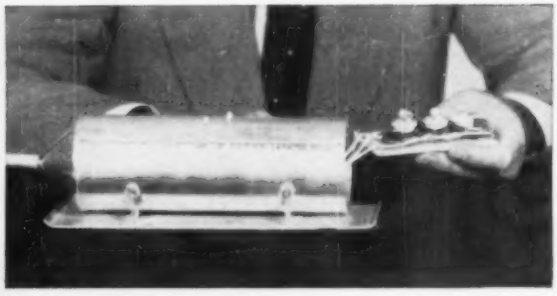
# Radiation Tolerant 500C Devices Shown

Servo motor (upper left) and transformer (upper right) capable of operating at 500C temperatures were among devices recently displayed by General Electric to show its progress toward development of high temperature, radiation-tolerant avionic components and devices. (AW Sept. 10, p. 112)

Effect of 800C temperature on avionic subassembly constructed from conventional components and another using new GE components is shown in side-by-side comparison at right.

Multivibrator circuit (lower left) constructed from new GE components is identical to unit that successfully passed recent 1,000 hour test in nuclear reactor under high neutron flux density and 450C temperature. Device was housed in metal capsule (lower right) for reactor tests.





## FILTER CENTER

▶ **For Experimental Use**—Sample quantities of General Electric's new high temperature[1] capacitors, resistors, and transformers, capable of operating at temperatures of 500C or higher (AW Sept. 10, p. 112) will be available soon to avionics manufacturers for experimental use. Resistors will be available from GE's Specialty Electronic Components Dept., Auburn, N. Y.; transformers from GE's Specialty Transformer Dept., Ft. Wayne, Ind., and 500C mica capacitors from company's Capacitor Dept., Hudson Falls, N. Y.

▶ **Matador Inertial Guidance**—AC Spark Plug Division of General Motors has revealed that it is producing the inertial guidance system used on the new Martin Matador (TM-61B) surface-to-surface missile.

▶ **New Ceramic Tube Types**—General Electric soon will announce six new types of ceramic receiving tubes, all triodes, designed specifically for military applications and capable of operating at temperatures of 500C. The six types will cover range of ratings up to 100 ma. Sample quantities should be available late this year.

▶ **Lear Abroad**—Sweden will outfit its SAAB J-35 supersonic fighters with Lear automatic flight control systems, Lear president R. M. Mock reports.

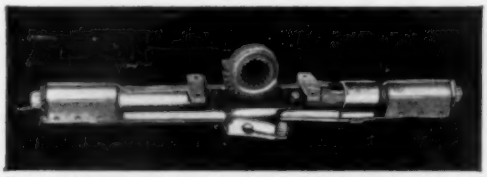
▶ **Fowl ECM**—Metal chaff used for electronic counter measures, which dropped on a chicken farm near Elmira, N. Y., caused a number of "fowl" deaths among hungry residents who ate it and the rest of the flock is suffering severe indigestion, the Associated Press reports. Elmira is not too far from Rome Air Development Center which conducts extensive ECM tests.

▶ **Solar Power To Get Cheaper**—Substantial reduction in the cost of making silicon solar cells should cut the cost of generating electricity by this means from the present $600 per watt to approximately $30 per watt, according to Dr. M. B. Prince, research director Hoffman Electronic Corp., Semiconductor Division.

▶ **Industrial Preparedness Studies**—Reports on two industrial preparedness studies, one on transistors and transistor manufacturing equipment and the other on silicon power rectifiers, sponsored by Army Signal Corps, are now available from Dept. of Commerce, Office of Technical Services, Washington 25, D. C. Transistor report consists of two volumes: PB 111822, 200 pages, $5.00, and PN 111820, 42 pages, $1.25. Silicon rectifier study report is PN 111819, 42 pages, $1.00.

▶ **Radar ADF?**—Flush-mounted antenna design which develops a good cardioid pattern at 2,500 mc., similar to that of a low frequency ADF loop and sense antenna, was described in a Wescon paper by F. D. Clapp of the University of California's Electronics Research Laboratory and H. Masuda of Hughes Aircraft Co. By providing a suitable rotary feed, Clapp and Masuda say the design could provide a completely flush mounted direction finder antenna. This prompts speculation that the antenna could be used for an ADF operating against ground radar stations.

▶ **New UHF Transistor Structure**—New technique for greatly increasing the high frequency capabilities of transistors by injecting carriers directly into the space charge region of a reverse biased P-N junction was suggested by Wolfgang Gaertner, Signal Corps Engineering Laboratories, in a paper delivered at Wescon. Gaertner calls the new device a Depletion Layer Transistor. The Signal Corps Laboratory is experimenting with the new type UHF transistor, Gaertner indicated.

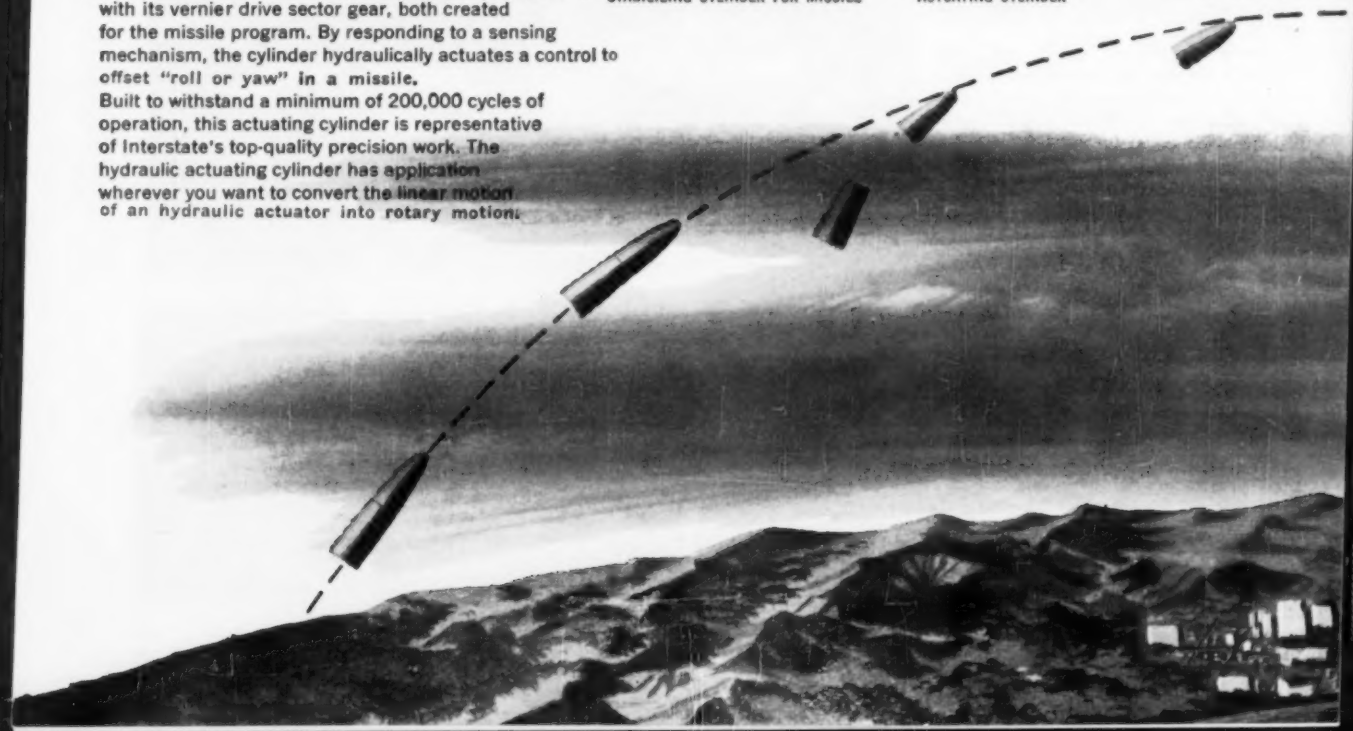
This is Interstate's vernier hydraulic actuating cylinder, with its vernier drive sector gear, both created for the missile program. By responding to a sensing mechanism, the cylinder hydraulically actuates a control to offset "roll or yaw" in a missile.
Built to withstand a minimum of 200,000 cycles of operation, this actuating cylinder is representative of Interstate's top-quality precision work. The hydraulic actuating cylinder has application wherever you want to convert the linear motion of an hydraulic actuator into rotary motion.

COMPENSATOR HYDRAULIC STABILIZING CYLINDER FOR MISSILE

BOMB BAY SPOILER ACTUATING CYLINDER

NIKE LAUNCHER CYLINDER

TA VALVE



## Expansions, Changes In Avionics Industry

**Litton Industries,** Beverly Hills, Calif., will purchase Triad Transformer Corp., Los Angeles, and its Indiana subsidiary, Utrad Corp. The new acquisitions, which make transformers, reactors, wave filters and related products, had sales of $3.5 million last year, while Litton's sales were $15 million.

Other recently announced expansions, changes and additions in the avionics field include:

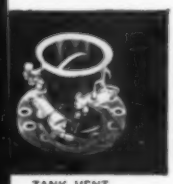
• **Westinghouse Air Arm Division** will add 70,000 sq. ft. of floor space to its present Baltimore facility. Completion is scheduled for Jan. 1, 1957. Air Arm employment has jumped from 3,200 to 4,400 in the past six months and the figure is expected to double in the next year, according to Dr. S. W. Herwald, division manager.

• **Lear, Inc.,** has opened new instrument research and development building adjoining its other facilities at the Santa Monica Municipal Airport.

• **General Electric's Microwave Laboratory,** Palo Alto, Calif., becomes part of GE's Power Tube Dept. in move in-

**Project Vanguard Minitrack**

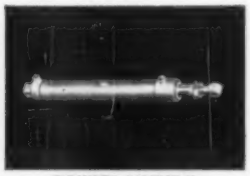
**Minitrack radio transmitter, developed by Naval Research Laboratory for earth satellite, will transmit 108 mc. signal enabling ground stations to track satellite movement. Small crystal controlled transmitter uses transistors, weighs only 13 oz. Unit puts out 10 milliwatts, is powered by mercury batteries.**

TANK VENT VALVE ASSEMBLY

CYLINDER ASSEMBLY NOSE LOADING DOOR JAM LATCH

SOLENOID OR MOTOR ACTUATED POPPET SHUT-OFF VALVE



CYLINDER ASSEMBLY NOSE LOADING DOOR OPERATING

TAIL SNUBBER CYLINDER

America's Inter-continental Ballistic Missile program is designed primarily to preserve peace —by warning any would-be aggressor that retaliation will be swift and terrible! But if the aggressor should strike, the ICBM will help assure victory! Research scientists and production engineers at Interstate Engineering are proud to be making their contribution to ICBM through the vernier hydraulic actuating cylinder pictured above, and through the development of other component parts. Interstate is capable of engineering and fabricating any pneumatic or hydraulic type cylinder. Whether your needs be cylinders, valves, airframe components or precision work of any kind, phone, write or wire for complete brochure detailing our equipment and production background.

**FOR PEACE... OR VICTORY!**

*Interstate*

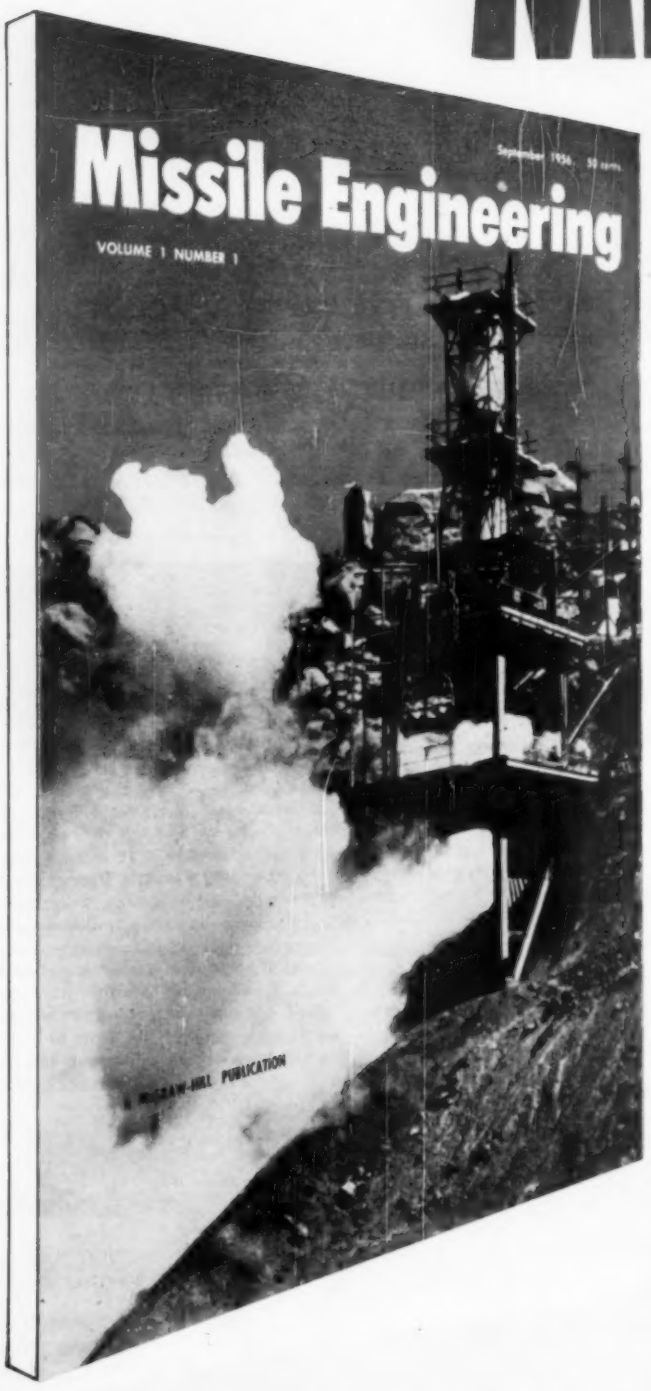
ENGINEERING CORPORATION

Dept. 50, 2250 E. Imperial Highway, El Segundo, California

**NEW SERVICE TO READERS...**

# AVIATION WEEK

# Missile



# ANNOUNCES

# Engineering

## A quarterly review of the most significant missile material appearing in regular issues of Aviation Week

NOW! MISSILE ENGINEERING, published by AVIATION WEEK, will provide a useful reference work for the military-engineering-management team. The first issue, published in September 1956, includes material selected from that reported by AVIATION WEEK'S staff of experts during the first nine months of this year. The second issue will appear in December covering the final quarter of 1956 and publication will be quarterly, thereafter.

AVIATION WEEK is used continually as a technical reference on missile development by the military services and the engineering-management staffs of the missile industry. Already the leader in reporting the major technical missile developments first, when this information is most useful to its readers in their work, AVIATION WEEK will continue to expand and intensify its weekly coverage of the missile industry.

AVIATION WEEK pioneered editorial coverage of the expanding guided missile development program during the past nine years and currently publishes more material about the billion dollar missile industry than any other publication. Our staff of technically qualified experts who will edit MISSILE ENGINEERING has reported Air Force, Navy and Army missile developments on-the-spot from all the major military test and development centers and from the industry responsible for development of missile weapon systems.

Head of AVIATION WEEK'S technical staff, Asst. Managing Editor David Anderton, worked in the missile industry on an early ballistic missile weapon system and as a chief project engineer. He is currently attending the International Congress of Astronautics Meeting in Rome as a delegate. Other staff members have had practical experience in the industry in missile propulsion and avionics before joining AVIATION WEEK. The 24 man editorial staff of AVIATION WEEK, combining professional editorial experience with practical technical knowledge of the industry, is unmatched in the aviation publication field and is particularly suited to provide the most complete and technically accurate coverage of the rapidly expanding missile industry.

MISSILE ENGINEERING is limited to companies and individuals directly concerned with the missile program at 50 cents a copy, $2 per year. Send in your request to:

**AVIATION WEEK**

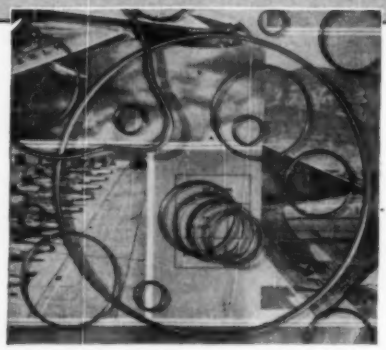
ABP ABC

A McGRAW-HILL PUBLICATION

330 WEST 42ND STREET, NEW YORK 36, N.Y.

# Looking for a BETTER WAY?

## Metal-O-Rings of advanced design



now give you **positive static sealing** with low flange load. For aircraft, atomic energy and industrial high temperature service on fuel, hydraulic, vapor, gas or compressed air lines and connections. Won't deteriorate with high temperatures and pressures, radioactive, electronic, acid or corrosive conditions, most chemicals, oils and greases.

Consider these additional advantages over conventional seals: most complete line, thinner walls, special shapes, lighter weight.

For better products of the future, every design engineer will want this important catalog at his fingertips . . . YOURS for the asking .

THE ADVANCED PRODUCTS COMPANY
595 Broadway, North Haven, Conn.

Wickes

# CONTROL TOWERS FOR EVERY NEED

**FIXED • PORTABLE • EMERGENCY**

New Wickes MS-14-B Tower
Overall Dimensions 6' x 6' - 7' high
Slanted windows reduce reflection

**Light weight, durable, maintenance free construction of aluminum and fiberglass.**

**Controls and equipment custom assembled to meet any specific requirement from the Wickes line of standard control and communication components.**

*Consult us for your control tower requirements.*

Wickes ENGINEERING AND CONSTRUCTION COMPANY
ESTABLISHED 1920
12TH STREET AND FERRY AVENUE — CAMDEN 4, NEW JERSEY


## Reprints Available

Reprints of Aviation Week's recent series of two articles on the USAF's new integrated instrument panel presentation (July 23, 30) are now available at 50¢ per copy.

"How to Prepare Papers the Easy Way," an article by Avionics Editor Philip J. Klass on the effective communication of technical ideas (AW, July 2, 1956), is available at 10¢ per copy with a 10% discount on quantities of 10 or more.

Requests should be addressed to Aviation Week, McGraw-Hill Publishing Co., 330 W. 42nd Street, N.Y. 36, N.Y.

tended to strengthen link between product research and manufacturing.

• **American Broadcasting-Paramount Theatres, Inc.** and **The Western Union Telegraph Co.** purchased a 25% interest in Wind Tunnel Instrument Co., Inc., Newton, Mass. The latter makes mechanical and strain gage balance systems, automatic controls and data handling systems, wind tunnel designs and high-speed models.

• **Automatic Electric Co.**, Chicago, will increase floor space of its new suburban Chicago facility, now under construction, by 200,000 sq. ft., bringing total to 1.5 million sq. ft.

• **Humphrey Inc.**, San Diego, maker of gyros, accelerators and pots, will market its full product line directly instead of through previous outside distributor. Plant is located at 2805 Cannon St.

• **Airtron, Inc.**, Linden, N. J., microwave component manufacturer, has formed new Canadian manufacturing and sales operation to be called Airtron Canada Ltd. W. J. Muller will head production at Renfrew, Ontario manufacturing plant. E. D. Smith will head sales office in Toronto.

## New Avionic Bulletins

• **Decimal digitizers,** for analog-to-digital or digital-to-analog conversion, in three, four, five and six decade types, are described in four-page Bulletin CR-181. Coleman Engineering Co., Inc., 6040 West Jefferson Blvd., Los Angeles 16, Calif.

• **Portable tape recorder and playback,** called "DataTape," is described in 26-page brochure, identified as Bulletin 1561B. Consolidated Electrodynamics Corp., 300 No. Sierra Madre, Pasadena, Calif.

• **Microwave silicon diodes,** their specifications and design application. Catalog 56S. Microwave Associates, 22 Cummington St., Boston, Mass.

• **Shaft-position encoder,** photo-electric type for analog-to-digital conversion, including models with non-linear read-out. Bulletin 4605 (4 pp.). Electronics Corp. of America, Dept. 500, 77 Broadway, Cambridge 42, Mass.

• **Data processing system,** for dynamic analog-to-digital data conversion. Bulletin

3003A (8 pp.). Consolidated Electrodynamics Corp., 300 No. Sierra Madre, Pasadena, Calif.

• **Airborne a.c. to d.c. converter,** employing no tubes, and 400 cps. aircraft single and three-phase transformers are described in new brochures available from Electrosolids Corp., 7436 Varna St., North Hollywood, Calif.

• **Bendix-Decca Navigator** is described and its operational features given in 20-page brochure available from Pacific Division, Bendix Aviation Corp., 11600 Sherman Way, North Hollywood, Calif.

• **"Amplitude and Phase Curves for Ground-wave Propagation in the 200 Cps to 500 Kc. Band,"** by James R. Wait and H. Herbert Howe of National Bureau of Standards. NBS Circular No. 574. (17 pp.). Price: 20 cents. Order from Government Printing Office, Washington 25, D. C.

• **Resistor engineering guide,** giving application data on complete line of International Resistance Company resistors. Company's address: 401 No. Broad St., Philadelphia, Pa.

• **Microwave components,** including magnetrons, diodes, TR and ATR tubes, reference cavities and waveguide pressure windows, are described in Catalog 56BG. Microwave Associates, Inc., 22 Cummington St., Boston, Mass.

• **Sweep-Synch,** Model 201, automatic sweep generator for use with cathode ray oscilloscopes, is described in two-page bulletin. Chadwick-Helmuth Co., 472 East Duarte Road, Monrovia, Calif.

• **Proximity transducer systems** for machine control are described in four-page bulletin No. CPP356. Electro Products Laboratories, 4500 No. Ravenswood Ave., Chicago 40, Ill.

## Certificates of Necessity

Office of Defense Mobilization has awarded a $4.5 million certificate of necessity for rapid tax amortization to Titanium Metals Corp. of America for titanium melting facilities. Of the total amount, 90% is allowed at the accelerated rate.

Other certificates awarded for the period July 26 through August 8:

**Boeing Airplane Co.,** Seattle, Wash., military aircraft, $1,442,000 certified with 60% allowed.

**Air Products, Inc.,** Emmaus, Pa., mobile liquid oxygen generating equipment, $297,332 certified with 65% allowed.

**Glen L. Martin Co.,** Baltimore, Md., military aircraft, $232,985 certified with 65% allowed.

**United Aircraft Corp.,** Pratt & Whitney Aircraft Division, East Hartford, Conn., jet engines for military aircraft, $302,000 certified with 65% allowed.

**Goodyear Aircraft Corp.,** Akron, Ohio, military aircraft parts, $429,990 certified with 65% allowed.

**Ex-Cell-O Corp.,** Detroit, Mich., military aircraft parts, $373,406 certified with 65% allowed.

**Beech Aircraft Corp.,** Wichita, Kans., military aircraft, $69,983 certified with 65% allowed.

**United Tool and Die Co.,** West Hartford, Conn., military aircraft parts, $91,348 certified with 70% allowed.

**Designers for Industry, Inc.,** Cleveland, Ohio, research and development, $273,102 certified with 40% allowed.

**Narmco Manufacturing Co.,** San Diego, Calif., military aircraft parts, $179,683 certified with 45% allowed.

**Reaction Motors, Inc.,** Morris Co., N. J., research and development, $558,000 certified with 70% allowed.

**Lockheed Aircraft Corp., Georgia Division,** Marietta, Ga., military aircraft, $678,646 certified with 65% allowed.

**Denison Engineering Co.,** Columbus, Ohio, military aircraft parts, $373,372 certified with 40% allowed.

**Dyna-Empire, Inc.,** Garden City, N. Y., jet engine parts, $233,385 certified with 50% allowed.

**Fairchild Engine Division,** Fairchild Engine & Airplane Corp., Long Island, N. Y., military aircraft engines, $1,388,938 certified with 65% allowed.

**Mangus Tool & Die Co.,** Mountainside, N. J., military aircraft parts, $258,686 certified with 50% allowed.

**Douglas Aircraft Co., Inc.,** Santa Monica, Calif., military aircraft, $2,592,375 certified with 65% allowed.

**Temco Aircraft Corp.,** Garland, Texas, military aircraft subassemblies, $36,200 certified with 60% allowed.

**Northrop Aircraft, Inc.,** Hawthorne, Calif., military aircraft, $95,000 certified with 65% allowed.

## USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

**OGDEN AIR MATERIEL AREA, Hill Air Force Base, Utah.**

**The Massillon-Cleveland-Akron Sign Company,** 681 First Street, S.W. Massillon, Ohio, tow target, aerial, banner style, radar reflective type MA-7, 2700 ea. (IFB 42-600-56-243), $134163.

**Northrop Aircraft Inc.,** Hawthorne, Calif., repair and reconditioning of crash damaged F89 aircraft (PR 00-555352 and 00-555352-1), $379849.

**RCA Service Co. Inc.,** Cherry Hill, Delaware Township, Camden, N. J., 2900-676750 projector, 281 ea, 2900-616800 projector, 168 ea. (RFP-PPCS-1-56-35), $32,675.

**Hondaille Industries, Inc.,** Buffalo Hy-


*This announcement is neither an offer to sell nor a solicitation of an offer to buy any of these Shares. The offer is made only by the Prospectus.*

***1,145,011 Shares***

# *North American Aviation, Inc.*

***Capital Stock***

*($1 Par Value)*

***Rights, evidenced by subscription warrants, to subscribe for these shares have been issued by the Company to the holders of its Capital Stock, which rights will expire at 3:30 P.M., Eastern Daylight Saving Time on September 24, 1956, as more fully set forth in the Prospectus.***

***Subscription Price $38 a Share***

***The several Underwriters may offer shares of Capital Stock at prices not less than the Subscription Price set forth above (less, in the case of sales to dealers, the concession allowed to dealers) and not more than either the last sale or current offering price on the New York Stock Exchange, whichever is greater, plus an amount equal to the applicable New York Stock Exchange Commission.***

*Copies of the Prospectus may be obtained from only such of the undersigned as may legally offer these Shares in compliance with the securities laws of the respective States.*

***MORGAN STANLEY & CO.***

| | | |
|---|---|---|
| ***THE FIRST BOSTON CORPORATION*** | | ***KUHN, LOEB & CO.*** |
| ***BLYTH & CO., INC.*** | ***EASTMAN DILLON, UNION SECURITIES & CO.*** | |
| ***GLORE, FORGAN & CO.*** | ***GOLDMAN, SACHS & CO.*** | ***HARRIMAN RIPLEY & CO. Incorporated*** |
| ***KIDDER, PEABODY & CO.*** | | ***LEHMAN BROTHERS*** |
| ***MERRILL LYNCH, PIERCE, FENNER & BEANE*** | | ***SMITH, BARNEY & CO.*** |
| ***STONE & WEBSTER SECURITIES CORPORATION*** | | ***WHITE, WELD & CO.*** |
| ***DEAN WITTER & CO.*** | ***DREXEL & CO.*** | ***HORNBLOWER & WEEKS*** |
| ***PAINE, WEBBER, JACKSON & CURTIS*** | | ***WERTHEIM & CO.*** |

*September 11, 1956.*

# STEEL

*Every Kind*

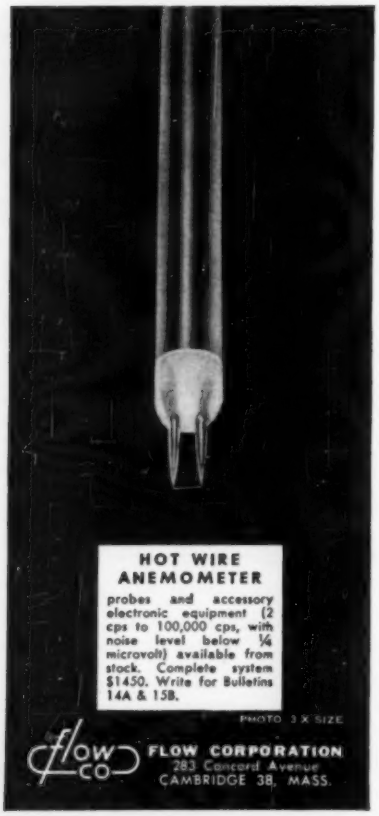
*Quick Delivery*

**Aircraft Quality Alloys and Stainless Steels also bars, structurals, plates, sheets, tubing.**

# RYERSON

**Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Wallingford, Conn., Philadelphia, Charlotte, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Milwaukee, Chicago, St. Louis, Seattle, Spokane, Los Angeles, San Francisco**





**HOT WIRE ANEMOMETER**

probes and accessory electronic equipment (2 cps to 100,000 cps, with noise level below ¼ microvolt) available from stock. Complete system $1450. Write for Bulletins 14A & 15B.

PHOTO 3 X SIZE

flow co **FLOW CORPORATION**
283 Concord Avenue
CAMBRIDGE 38, MASS.


draulic Div., 537 E. Delaware Ave., Buffalo 11, N. Y., 4606-A1560 piston assy, 15 ea, 4606-D625211-1 damper, 122 ea. (PR-00-562785), $57303.

**Scott Aviation Corp.**, 207 Erie St., Lancaster, N. Y., training aid, oxygen regulator high altitude, 160 ea, (IFB 42-600-56-292), $79478.

**Western Fishing Line Co.**, 4680 San Fernando Road, Glendale 4, Calif., cord, nylon, coreless for tow cables (IFB 42-600-56-323), 2354 ea, $79565.

**SHELBY AIR FORCE DEPOT, Wilkins Air Force Station, Shelby, Ohio.**

**Skyline Clothing Corp.**, 173 Rombout Ave., Beacon, N. Y., (RFP 33-602-56-3048), jacket, flying man's, nylon twill, type MA-1, 24949 ea, $386709, less ½ percent reduction for award of all items $1933, total $384775.

**Hammond Organ Co.**, 4200 West Diversey Ave., Chicago 39, Ill., (IFB 33-602-56-138), organ, electric, 35 ea, $36496.

**Killington Mfg. Co., Inc.**, 90 Merchants Row, Rutland, Vt. (IFB 33-602-56-116), glove set, flying, leather gauntlet style, IAW spec MIL-G-7496A, 22839 pr, $65991.

**Mechanical Devices Co.**, 915 East Oakland Ave., Bloomington, Ill. (IFB 33-602-56-109), parts, appl; type B1 and B2 acft maint platform, 11278 ea, $25310.

**Aeroaffiliates, Inc.**, P. O. Box 4125, Hicks Field, Fort Worth, Tex., hoists-tube set IAW spec USAF exhibit SWV 55-613 dtd 5 Jul 55, 276 ea, $1125185, technical date IAW MCMTT exhibit no. 1-10, $5520, total $1130705, (PR 547716).

**Anchor Coupling Co., Inc.**, 342 N. Fourth St., Libertyville, Ill., hose assy, hi-pres. IAW USAF dwg 44B27648 and 48B3659 (IFB 33-602-56-173), 60100 ea, $220676.

**Turnbull Enterprises, Inc.**, 1414 Lovegrove St., Baltimore 2, Md., kit-airplane mooring spec MIL-K-6102, dtd 5 Apr 50 (IFB 33-602-56-120), 1181 ea, $64329.

**Smith-Nelson Corp.**, 36 East Mason Street, Santa Barbara, Calif., jack, hand hyd. axle 50 ton cap, type F-3 IAW spec MIL-J-8245 (USAF) dtd 26 Mar. 53 and amend, 1 dtd 16 Sept. 54, 281 ea, maintenance data, 1 lot, $146967, (RFP 33-602-56-3015).

**Northrop Aircraft, Inc.**, Hawthorne, Calif., miscellaneous spare parts for N703 sling acft maint; N704 sling acft maint; and 8200-903312 tow bar airplane towing & steering (PR WL-547917, 547918, 547919), 3266 ea, $35693.

**United States Rubber Co.**, No. 1 Market Street, Passaic, N. J., hose aircraft (IFB 33-602-56-166), 150000 ft, 300 ea, $26136.

**Turnbull Enterprises, Inc.**, 1414 Lovegrove St., Baltimore 2, Md., kit-airplane mooring part no. AN8015-2 spec MIL-K-6102 dtd 5 Apr. 50 (IFB-33-602-56-85), 575 ea, $32441.

**Welsh Mfg. Co.**, 9 Magnolia Street, Providence 9, R. I., glasses, sun; neutral lens, metal frames type G2 (10 pr. per pkg) IAW spec MIL-G-6250B dtd 22 Sep 53 (RFP 33-602-56-3060), 26250 pr., $60112.

**Seymour Wallas & Co.**, 1200 S. 8th St., St. Louis 4, Mo., suitcase, cotton duck, center folding type, 1 handle with slide fastener closure, type B-4B, AF dwg no. 52K6757 (IFB 33-602-56-140), 2400 ea, $37025.

**General Dynamics Corp.**, Convair Div., Fort Worth, Tex., supplies of service appl: SE2247 harness assy and SE2329 bin, 3560 ea, $67916.

**DAYTON AIR FORCE DEPOT, Gentile Air Force Station, Dayton 10, Ohio.**

**Electronic Brazing Co.**, 140 Glenridge Ave., Montclair, N. J., tester assy, fire detector system field in a/w AFD WB 48D 6129, 437 ea, technical pub requirements for test equip. in a/w MDMTT exhibit 1-16B (IFB 33-604-56-132), $45411.

**Radio Condenser Co.**, Davis & Capewood Sts., Camden 3, N. J., capacitor-variable, air dielectric plate meshing type, RCC CN-800132 (RFP 33-604-56-2424), 1600 ea, $32368.

**Cook Electric Co.**, 2700 Southport Ave., Chicago 14, Ill., services—repair, test equipment for electrical and electronic equipment, 11 items, var quantities, $34804.

**Barber-Colman Co.**, Rockford, Ill., resistor-thermal, contractor's nr AYLF 4179, 1000 ea, $52300.

**Amperex Electronics Corp.**, 230 Duffy Ave., Hicksville, L. I., N. Y., electron tubes-type JAN 5894 a/w MIL-E-1/152 dtd 20


**To the ENGINEER of high ability**

Through the efforts of engineers The Garrett Corporation has become a leader in many outstanding aircraft component and system fields.

Among them are:

air-conditioning

pressurization

heat transfer

pneumatic valves and controls

electronic computers and controls

turbomachinery

The Garrett Corporation is also applying this engineering skill to the vitally important missile system fields, and has made important advances in prime engine development and in design of turbochargers and other industrial products.

Our engineers work on the very frontiers of present day scientific knowledge. We need your creative talents and offer you the opportunity to progress by making full use of your scientific ability. Positions are now open for aerodynamicists ... mechanical engineers ... mathematicians ... specialists in engineering mechanics ... electrical engineers ... electronics engineers. For further information regarding opportunities in the Los Angeles, Phoenix and New York areas, write today, including a resumé of your education and experience. Address Mr. G. D. Bradley

THE GARRETT CORPORATION
9851 So. Sepulveda Blvd.
Los Angeles 45, Calif.

DIVISIONS
AiResearch Manufacturing, Los Angeles
AiResearch Manufacturing, Phoenix
AiResearch Industrial
Rex — Aero Engineering
Airsupply — Air Cruisers
AiResearch Aviation Service

# Mobile gas turbine power cart

## *takes only 30 seconds to start giant B-52 jet engines*

The AiResearch MA-1A mobile gas turbine compressor, the first unit of its kind qualified by the Air Force to start the intercontinental B-52 bombers of the Strategic Air Command, is now in volume production at the AiResearch Manufacturing Division of Arizona.

Entirely self-contained, it furnishes a completely automatic source of compressed air power at the point of use. All components, parts and accessories are included in the fully-enclosed weather-proofed trailer.

The mobile unit weighs only 1150 pounds and may be controlled either from the instrument panel or from a remote control panel. It will start and maintain continuous operation at ambient temperatures ranging from −65°F to 130°F, together with the other extremes of environmental conditions encountered at airports throughout the world.

The two-stage gas turbine compressor may be removed easily from its trailer for use in other vehicles or as a stationary unit. It has an output capacity of 120 pounds per minute flow at 50 psia... enough power to meet all ground service needs for a modern airplane.

Write to our Sales Planning Department for further information on this product.

*Qualified engineers are needed now. Write for information.*

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

*Los Angeles 45, California • Phoenix, Arizona*

*Designers and manufacturers of aircraft systems and components:* REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

NO MATTER HOW

YOU LOOK AT IT

**You can look easier with the Steinen Inspection Mirror**

Designed specifically to SEE into all hard-to-get-at places such as engine and tail sections, fusilage or wing frames. Ideal also for maintenance of all plant and factory equipment.

**OUTSTANDING FEATURES:**

- ★ ADJUSTABLE TELESCOPING HANDLE extends and locks to any length from 14-33 inches.
- ★ FURNISHED WITH 4¼" ROUND DOUBLE-FACED MIRROR OR 2" x 4¼" RECTANGULAR MIRROR . . . quickly and easily interchangeable.
- ★ DOUBLE ACTION SWIVEL can be used at any angle.
- ★ WEIGHS ONLY 9 OUNCES folds compactly against handle.

*Order enough for your whole inspection and maintenance department.*

Only $3.95
$1.40 for replacement mirror

STEINEN

WM. STEINEN MFG. CO.
ESTABLISHED 1875 — 43 Bruen St., Newark 5, N. J.



*Now!... the NEW*

**ROBINSON WIRE TWISTER**

*with DIAGONAL GRIP-HEAD*

Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow- hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

**3-TOOLS-IN-1** . . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

**12"** —for assembly line safety wiring, 15 oz. **$21.50**

**9"** —for bench work, sub-assemblies, 12 oz. **$20.50**

Unconditional Money-Back Guarantee. Send for complete details.

**RALPH C. ROBINSON CO.**
Box 494W No. Sacramento 15, Calif.

Canadian Distributor, Gensales, Ltd., Malton, Ont.


May 53, spec MIL-E-1C dtd 3 Oct 55 and suppl 1A dtd 26 Oct 55, 1800 ea, (PR 638-592), $30600.

**Jackson Electrical Instrument Co.**, 18 S. Patterson Blvd., Dayton 2, Ohio, services-repair, test equipment for electrical and electronic equipment, 7 items, var quantities, $42245.

**Cook Electric Co.**, 2700 Southport Ave., Chicago, Ill., services—repair, test equipment for electrical and electronic equipment, 8 items, various quantities, $40716.

**Bendix Aviation Corp.**, Bendix Radio Div., Baltimore, Md., panel-control C-784 in a/w MIL-R-25061 and MIL-C-6781, 757 ea, engrg data, maintenance data, (PR 687573), $271006.

**Adler Electronics, Inc.**, 1 LeFevre Lane, New Rochelle, N. Y., signal generator SG-13/ARN in a/w Mil Spec MIL-S-4298 (USAF) dtd 12 Jul 51 and amend. no. 1 dtd 16 Nov 53, 310 ea, engrg data, maintenance data, running spare parts (equipment spares) for above i.e., vacuum tubes, fuses, lamps, etc., 161 sets, tabular list of parts for signal generators in a/w spec MIL-T-10186A, 6 ea, (IFB 33-604-56-119), $250867.

**Bendix Aviation Corp.**, Eclipse-Pioneer Div., Teterboro, N. J., tester—accuracy directional instrument, eclipse pioneer P/N 12703-1-A, 17 ea, maintenance spare parts, maintenance data, (RFP 33-604-56-2824), $94636.

**Thompson Products, Inc.**, Electronics Div., 2196 Clarkwood Rd., Cleveland 3, Ohio, switch-rotary SA-185/U in a/w spec MIL-R-8912 dtd 30 Oct 52 and ardt. nr 2 dtd 28 Jul 55, 1093 ea, maintenance data, (IFB 33-604-56-219), $65599.

**Jennings Radio Mfg. Corp.**, 970 McLaughlin Ave., San Jose, Calif., capacitor-variable vacuum dielectric jennings radio P/N UHC 10-75, 200 ea, (RFP 33-604-56-3456), $29364.

**Sylvania Electric Products, Inc.**, 1740 Broadway, New York 19, N. Y., tube electron receiving triode JAN type 12AT7WA a/w spec MIL-E-1B dtd 2 May 52, amend No. 3 thereto dtd 12 Nov 53, suppl LZ thereto dtd 23 Aug 55 and individual spec sheet MIL-E-1/3 dtd 13 Jan 53, 25000 ea, (IFB 33-604-56-257), $49500.

**Microwave Associates, Inc.**, 22 Cummington St., Boston, Mass., crystal unit-rectifying silicon crystal a/w spec MIL-E-1C dtd 3 Oct 55, suppl 1A dtd 26 Oct. 55 and individual spec sheet MIL-E-1/657 dtd 23 Mar 54, 47000 ea, (IFB 33-604-56-258), $37136.

**Sprague Electric Co.**, Marshall St., North Adams, Mass., resistor-fixed comp. Sprague 1-106M (MEG-O-OMAX), 572 ea, resistor-fixed comp., Sprague 1-156K (MEG-O-MAX), 259 ea., resistor-fixed comp. mfg. P/N Sprague 2, 344 ea., resistor-fixed comp., mfr., P/N Sprague 1, 412 ea., resistor-fixed mfr., P/N Sprague 2, 400 ea., (RFP 33-604-56-3024), $32,432.

**Sensitive Research Instrument Corp.**, 310 Main St., New Rochelle, N. Y., voltmeter-electrostatic, Sensitive Research Instrument Corp., model no. ESH, 73 ea., commercial data publication requirements in a/w provisions of table IV, (RFP 33-604-56-2600), $26,378.

**Jackson Electrical Instrument Co.**, 18 S. Patterson Blvd., Dayton 2, Ohio, repair of 11 items var. quantities Signal generators, audio oscillators, tuned cavities and range calibrators, $30,156.

**Pan-Electronics Corp., Box** 404, Griffin, Ga., crystal unit CR-18/U metal plated, quartz frequency range 800 to 1,500 kc., in HC-6/U metal holder in a/w spec. MIL-C-3098A and suppl. no. 1 dtd. 19 Nov. 1952, 128,000 ea., (IFB 33-604-56-86), $125,440.

**Western Electric Co., Inc.**, North Carolina Works, Chatham Road, Winston-Salem, N. C., 20 items of variable attenuators, coils and transformers, capacitors, insulators, relays assys., var. quantities, $29,787.

**Hughes Aircraft Co.**, Misc. Sales, Bldg. 111, Sta. 50-12, Los Angeles 45, Calif., radar modification kits HAC-0842-508, 172 ea., time compliance tech. order (reproducible), 1 ea., $66,949.

**Cook Electric Co.**, 2700 Southport Ave., Chicago 14, Ill., services repair on direction finder set, 1336 ea., $74,820.

**Alloy Industries**, Sales Div. of Alloy Die


# AVRO AIRCRAFT

*offers opportunities for these people— with or without aeronautical experience:*

**Mathematicians • Computer Programmers • Aerodynamicists • Metallurgical Technicians • Stress Engineers • Systems Engineers • Mechanical Engineers • Flight Test Engineers • Controls Engineers • Aero Thermodynamicists • Vibration & Flutter Engineers • Civil Engineers for: Structural Analysis, tests, Design • Computing Specialists • Draftsmen & Technicians**

Avro Aircraft's broad and diversified range of advanced aeronautical design projects gives engineering people unexcelled opportunities to utilize individual ingenuity, initiative, imagination and creative qualities.

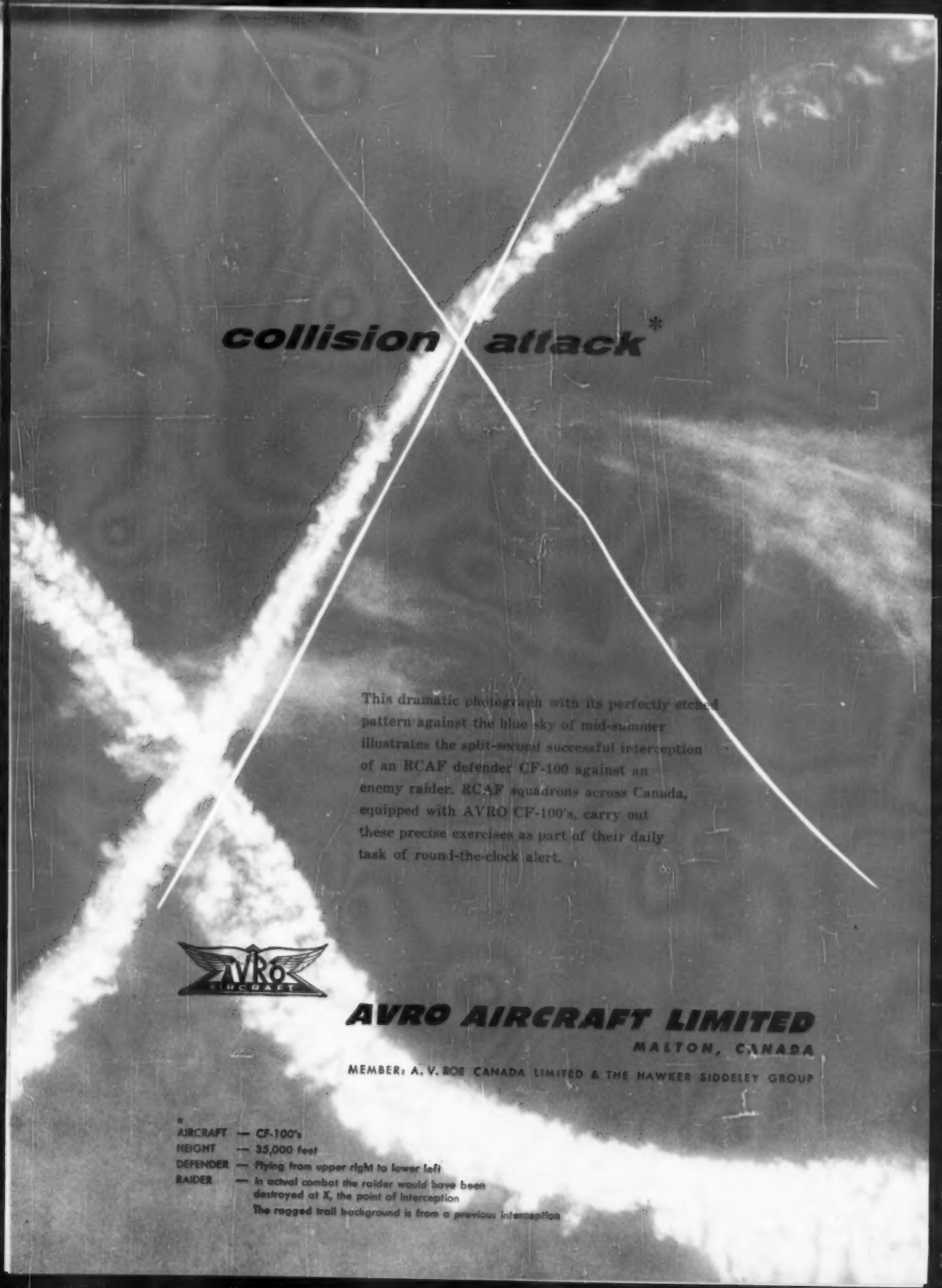
All aspects of Engineering at Avro employ the most up-to-date scientific techniques and modern facilities. These are under the guidance of some of the world's finest engineering talent. As members of a progressive design team, more concentrated job responsibility means more recognition for individual ideas and accomplishments.

You who are interested in responsible work now, on design concepts which represent the most advanced state of your art, should

Write today to:

EMPLOYMENT MANAGER,
AVRO AIRCRAFT LIMITED,
BOX 4004, TERMINAL 'A',
TORONTO, CANADA

AVRO AIRCRAFT


collision attack*
This dramatic photograph with its perfectly etched pattern against the blue sky of mid-summer illustrates the split-second successful interception of an RCAF defender CF-100 against an enemy raider. RCAF squadrons across Canada, equipped with AVRO CF-100's, carry out these precise exercises as part of their daily task of round-the-clock alert.
AVRO AIRCRAFT LIMITED
MALTON, CANADA
MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP
* AIRCRAFT — CF-100's
HEIGHT — 35,000 feet
DEFENDER — Flying from upper right to lower left
RAIDER — In actual combat the raider would have been destroyed at X, the point of interception
The ragged trail background is from a previous interception

## INFRARED SYSTEMS FOR DEFENSE

Infrared systems will provide from now on a new basis for air-to-air combat at high altitudes. Infrared advantages include long range, precise resolution and target discrimination, less scintillation phenomena, and freedom from electronic jamming.

In this field, Electronics Corporation of America is a pioneer, having held for more than a decade a position of leadership in the development and production of infrared radiation responsive systems, which see without revealing their presence.

ELECTRONICS CORPORATION
INFRARED SYSTEMS:

Missile Guidance
Fire Control
Celestial Navigation
Early Warning
Thermal Reconnaissance
Explosion Extinguishing
Fire Detection

**ELECTRONICS CORPORATION OF AMERICA**
One Memorial Drive, Cambridge, Massachusetts

E C A

Casting Co., 2211 Firestone Blvd., Los Angeles 2, Calif., switch-sensitive, 2,000 ea. units, (PR-714260), $31,595.

**Philco Corp.**, 4700 Wissahicken Ave., Philadelphia, Pa., 45 items of capacitors, airborne search and navigation radar maintenance parts, var. quantities, $101,516.

**Radio Corporation of America**, Tube Division, 19th and Federal Sts., Camden 2, N. J., cushion-earphone modified (for AIC-10 earphone) P/N RCA M123010, 25 ea., microphone M-32 AIC P/N modified RCA MI-24832C, 160 ea., $26,500.

**OKLAHOMA CITY AIR MATERIAL AREA, Tinker Air Force Base, Okla.**

**Thompson Products, Inc.**, Accessories Division, 23555 Euclid Ave., Cleveland 17, Ohio, housing assy. valve TV95-100-3, (RFP 372-031-3-OC-691676), 86 items, $201,772.

**Thompson Products, Inc.**, 23555 Euclid Ave., Cleveland 17, Ohio, shaft fuel pump turbine drive, (RFP 373-031-3-OC-69166B), 91 items, $226,576.

**Thompson Products, Inc.**, 23555 Euclid Ave., Cleveland 17, Ohio, rotor assembly-fuel pump, (RFP 285-031-3-OC-691666), 173 items, $279,896.

**Parker Aircraft Co.**, 5827 W. Century Blvd., Los Angeles 45, Calif., valve assy.-HYD check, (RFP 353-031-2-OC-699351), 18 items, $44,200.

**Marquette Metal Products Division**, Curtiss-Wright Corporation, 1145 Galewood Drive, Cleveland, Ohio, seal-high pressure valve seat hvd. motor, (RFP 346-03F-OC-646312), 53 items, $54,759.

**Jacobs Aircraft Engine Co.**, 750 Queen St., Pottstown, Pa., coupling assy. spring, (RFP 333-02B-OC-691583), 48 items, $300,-884.

**Aeroquip Corp.**, 300 South East Ave., Jackson, Mich., coupling, half assy., (RFP 271-031-1-0C-665401), 24 items, $122,385.

**Davis Aircraft Products, Inc.**, 1191 Spofford Ave., New York 59, N. Y., pump, (RFP 450-031-3-WR-433594M), 1 item, $40,242.

Lear-Romec Div. of Lear, Inc., Abbe Road, Elyria, Ohio, tie down 2 in cotton webbing strap cargo, (IFB 34-601-56-322), 1 item, $28,201.

**Jacobs Aircraft Engine Co.**, 750 Queen St., Pottstown, Pa., bearing assembly cam shaft rear, (RFP 300-02B-0C-693871), 1 item, $10,255.

**Schulz Tool and Manufacturing Co.**, 425 South Pine St., San Gabriel, Calif., cage fuel vent float valve alum, (RFP 340-031-1-0C-665285), 11 items, $40,543.

**HOLLOMAN AIR DEVELOPMENT CENTER, Holloman AFB, N. Mex.**

**Armour Research Foundation** of Illinois Institute of Technology, 10 West 35th St., Chicago, Ill., economic feasibility study of rocket fuels production (AF 29(600)-896), $96068.

**MIDDLETOWN AIR MATERIEL AREA, Olmstead Air Force Base, Middletown, Pa.**

**Gas Industries Inc.**, P. O. Box 538, Allentown, Pa., liquid oxygen and liquid nitrogen, 114862 tons, $1778524, PR MA-662023, 662023-1.

**Airton Inc.**, 1101 West Elizabeth Ave., Linden, N. J., harness assembly, thermocouple, Airton RFP PR MA-718592, 718592-1, 1037 ea, $197030.

**Dejur Amsco Corp.**, Northern Blvd., & 45th St., Long Island City, N. Y., lordmeter IFB PR SB-464607, 2412 ea, $17004.

**WARNER ROBINS AIR MATERIEL AREA, Borins Air Force Base, Ga.**

**Clements Mfg. Co.**, 6650 Narangansett Ave., Chicago 38, Ill., vacuum cleaner, hand type, exposed separator, (IFB 349), 3817 ea, $176928.

**Oliver Machinery Co.**, 445 Sixth St., N.W., Grand Rapids, Mich., grinder, oilstone, pedestal type (IFB 409), 70 ea, $37724.

**Aeroquip Corp.**, 300 S. East Avenue, Jackson, Mich., assembling machine, hose and fittings, bench type (IFB 359), 38 ea, $36024.

**AC Spark Plug Div.**, GMC, Milwaukee, Wis., modification kits for ME-5 bombing navigational computer, (PR 408057), $54758.

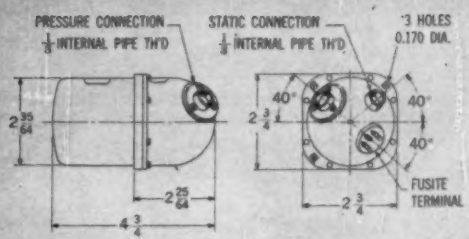
**Packaging Industries, Ltd.**, 151 Pine St.,

IERC
electron tube shields
IMPROVE
MISSILE
RELIABILITY...
help them get
where they're going!
MILITARY "B" TYPE HEAT-DISSIPATING
ELECTRON TUBE SHIELDS* END TUBE FAILURES
CAUSED BY HEAT AND VIBRATION!
IERC offers the only shields commercially available that will meet or exceed MIL-S-9372 for temperature resistance, vibration control, compatibility with all tube diameter tolerances and have approval as Heat-dissipation shields for providing lowest bulb operating temperatures through proper design and function.
Improve your equipment reliability—specify IERC "B" type shields to end premature tube failures caused by heat and vibration effects.
There is an IERC tube shield to fit your design and equipment needs. Write and ask for IERC technical bulletin 1204-356 on heat-dissipating shields and to receive new bulletins regularly.
International
electronic research corporation
145 West Magnolia Boulevard, Burbank, California
*Patents Pending—Cross-licensed with North American Aviation, Inc.

# new

**for**... *air data computers and flight controls*

## differential pressure synchrotel transmitter




*rotates a synchrotel linearly with indicated airspeed or log differential pressure up to one turn for full range*

Type B-23471

**Kollsman Pressure Sensors** are all manufactured to the exacting standards required for high-precision operation in our own computers and flight-control units.

**As compared to previous types:**

- **1/2 the static volume**—approximately 250 cc
- **2/3 the size**—shown in outline drawing
- **2/3 the weight**—approximately 14 ounces

*plus*... accuracy within ½% of value in most ranges

Write for detailed technical literature. Consult us on your missile or aircraft control problems.

**OTHER SYNCHROTEL TRANSMITTERS NOW IN PRODUCTION...**

of proven accuracy and reliability ...low, easy maintenance characteristics. Various types available for remote electrical transmission of: *true airspeed, indicated airspeed, absolute pressure, differential pressure, log differential pressure, altitude, Mach number, and pressure ratio.* Single- or two-speed Synchrotel outputs can be furnished on certain units.

**AVAILABLE SOON!**

New Log Absolute Pressure or Altitude Transmitters with same high-accuracy, low-weight, small-size characteristics as new transmitter featured above.

This new unit will have static volume of only 0.45 cubic inch!

**kollsman** INSTRUMENT CORPORATION

KOLLSMAN PRODUCES: Flight Instruments • Precision Computers and Components • Engine Instruments • Optical Systems and Components • Navigation Instruments • Precision Flight Controls • Motors and Synchros • Precision Test Instruments for Aviation and Industrial Laboratories

80-08 45th AVE., ELMHURST, NEW YORK • GLENDALE, CALIFORNIA • SUBSIDIARY OF *Standard* COIL PRODUCTS CO. INC.

Montclair, N. J., sealing machines, heat, bench and/or portable, (IFB 372), 69 ea, $92805.

**Sperry Gyroscope Co.,** Great Neck, N. Y., modification kits for ME-5 bombing navigational computers (PR 408085), $42021.

**AC Spark Plug Div.,** GMC, Milwaukee, Wis., replacement kits for ME-3 & ME-5 computer (PR 681207), $31518.

**Motorola, Inc.,** Chicago, Ill., repair, overhaul and mod radar components (PR-734923), $43069.

**Joy Mfg. Co.,** Michigan City, Inc., retrofit kits for compressors (PR-542379), $73604.

**Peck, Stow & Wilcox Co.,** Southington, Conn., squaring shear, foot powered, 18 ga X 96 in cap (IFB-356), 98 ea, $94570.

**Apex Machine Co.,** 14-13 118th Street, College Point, N. Y., machine—wire marking, hand operated, type 1, (IFB-335), 92 ea, $33304.

**TOPEKA AIR FORCE STATION, Topeka, Kans.**

**Detrex Corp.,** P. O. Box 501, Detroit 32, Mich., trichlorethylene (IFB 14-604-56-499), 1625000 gal, $182812.

**Marvel Mfg. Co.,** P. O. Box 335, Caldwell, N. J., aircraft propeller balancing kit (RFP 14-604-56-5178), 110 ea, $247500.

**SACRAMENTO AIR MATERIEL AREA, McClellan Air Force Base, Calif.**

**M. K. Porter Co., Inc.** of Pittsburgh, ESECO Div., 10 Third Ave., Joliet, Ill., kit, T.C.T.O.'s, P/N 8210-TO-35C3-3-15-501 (PR 5243), 584 units, $32984.

**North American Aviation, Inc.,** Los Angeles International Airport, Los Angeles, Calif., installation of advanced electronic equipment and IRAN of F86D type aircraft (PR 34408), 40, $616000.

**Temco Aircraft Corp.,** P. O. Box 6191, Dallas, Tex., pylon assy, BP 55 bomb and tank complete LH and RH (PR 6683), 7206 units, $4841351.

**National Presto Industries Inc.,** Eau Claire, Wis., pylon asy, BP55 bomb and tank complete LH & RH (PR 6683), 7206 units, $4841351.

**SAN ANTONIO AIR MATERIEL AREA, Kelly Air Force Base, Texas.**

**Beech Aircraft Corporation,** Wichita, Kans., IRAN maintenance, stripping and painting of 23 ea L-23 type aircraft, (PR 01-H-SA-546026, SA-546026-1, SA-546026-2, SA-546026-3, SA-546026-4, SA-546026-5, SA-546026-6, SA-546026-7, SA-546026-8, and SA-546026-9) (complete) $150970.

**Champion Spark Plug Company,** 900 Upton Ave., Toledo, Ohio, 4708-RC26S-plug, spark CHAMPION RC-26S, 294765 ea (PRO) 3-H-SA-734024, SA-734024-1 and SA-734024-3 (complete) $376414.

**Bendix Aviation Corporation,** Scintilla Division, Sidney, N. Y., 4708-JN16 igniter plug, 9926 ea (PR 03-H-SA-734026-1 and SA-734026-2 (complete), $26949.

**Continental Aviation & Engineering Corp.,** 12700 Kercheval Ave., Detroit, Mich., repair and overhaul of eight (8) each YJ-69-T-9 turbojet engines (PR 02A-SA-611200-2/F, SA-611200-1, 2/F), $43184.

**General Laboratory Associates, Inc.,** 17 E. Railroad St., Norwich, N. Y., exciter, 4721-12100-10, 900 ea (PR 03H-SA-720799, SA-72079901, SA-72079902, SA-72079903, (complete), $98460.

**AIR FORCE MISSILE TEST CENTER, Patrick Air Force Base (ARDC), Fla.**

**Ampex Corp.,** 710 Peachtree St., N. E., Suite 233, Atlanta 8, Ga., tape, 1790-NL831210-6, 3,527 roll, (PR Nos. AF-16N-IV-LP-56-20779, AF-16N-IV-LP-56-20733), $34,000.

**G. M. Giannini & Co., Inc.,** Datex Division, 1307 South Myrtle Ave., Monrovia, Calif., precision data recording equipment, cable sets, commutator sets, and test equipment, (PR No. FP-1 (57)-395), job, $91,-292.

**Potter Instrument Co., Inc.,** 115 Cutter Mill Road, Great Neck, N. Y., two handlers, magnetic tape, computer, (PR Nos. FP-1 (56)283, FP-1(56)336), job, $61,037

**Houston Fearless Division,** Color Corp. of America, 11801 West Olympic Blvd., Los Angeles, Calif., parabola, RCP-6, 12 ea., (PR No. FP-1(57)232), $52,010.


In air-foil sections, strength, accuracy and smoothness are of primary importance. These characteristics, plus a minimum of machining, are offered by this Antioch Process missile fin casting. The alloy: A-356. Tolerances of ±.010" in thickness and .020" T.I.R. on flatness are held in production. Surface finish, as cast, is better than 125RMS. Test bars machined from heavy hub section have minimum ultimate strength of 36,000 psi and elongation of 11%.

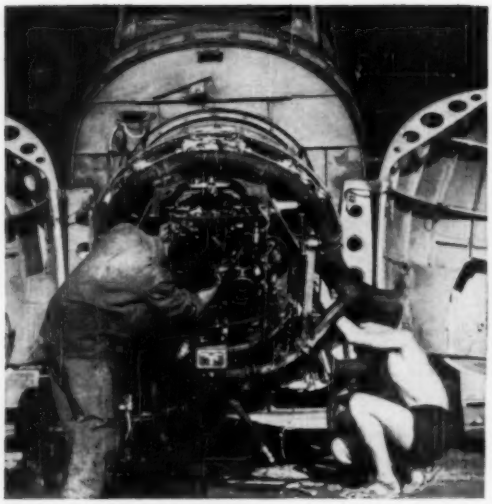
Morris Bean & Company specializes in casting parts for wave guide, fluid flow, and aircraft application to demanding standards and in volume production.

If your designs call for high performance aluminum parts, get acquainted with Morris Bean castings. Send us a part print for recommendations. Technical literature on request.

Morris Bean & Company
Yellow Springs 4, Ohio

**a cast rocket fin?**

BEAN



**S-55 MAINTENANCE WORK** at Boufarik. Two squadrons of Helicopter Group 57 are composed of eight S-55s (type H-19D3) each.

*Special Report from Algeria, Part II:*

# Algerian Terrain Challenges Helicopters

By Robert Farrell

**Boufarik, Algeria**—This main French air force helicopter base is located 30 mi. southwest of Algiers. Though at sea-level, Boufarik is within 20 mi. of rugged mountain regions where bitter fighting against rebel bands occurred. In almost every skirmish, helicopters from Boufarik played a big role.

Set up 15 months ago, Boufarik today has a personnel strength of 550 including 100 pilots and 200 mechanics. Commanded by Col. Devillers, the base, though carrying out an active flight operation, is obviously still in the process of being built. Hangers, barracks and maintenance facilities are noisily under construction. Helicopters kick up miniature dust storms as they land on the dirt field.

Mixed Helicopter Group 57 at Boufarik is composed of four squadrons.

The first squadron uses 15 Bell 47G2s, built under license by the Agusta firm of Milan, Italy, equipped with servo-controls. The second and third squadrons are composed of eight S-55s each (type H-19D3). The fourth squadron is equipped with ten new Sikorsky S-58s, or H-34As, one of them recently cracked up.

The initial report from the crash scene indicated pilot error. The ship was carrying 12 paratroopers in a combat operation when it went down. The accident marked the second S-58 crash since June, when the air force at Boufarik first began operating the heavy helicopter. The first accident, a training flight, was also blamed on pilot error.

The air force helicopter unit at Boufarik is entirely at the disposal of Ground Command in western Algeria. (The Army helicopter group generally handles eastern Algeria.) Air force officers here say their prime mission is to carry troops into mountainous combat areas, very often at 6,000 feet, and then to withdraw casualties.

Wounded, incidentally, are usually flown to base hospitals within an hour of being hit.

In addition to troop carrying and evacuation of wounded, which make up 75% and 10%, respectively, of Boufarik's helicopter missions, the air force craft also are used to supply remote outposts and to fetch downed fixed-wing pilots.

### Big Area

Understandably, all these missions couldn't be carried out from the home base at Boufarik. Take an area the size of the U.S. east of the Mississippi River and you have approximately the area of Algeria. Divide this area in half from the Mediterranean to the Sahara desert and you have the region that must be served by Boufarik's forty-odd helicopters. So to better accomplish the task, the bulk of the group's ships are assigned—usually in groups of three—to ground units throughout western Algeria up to the Moroccan border. A helicopter task force stays in the field on the average of three days, sometimes more if a big operation is being run off.

Since its beginning in June 1955, the Boufarik helicopter group has chalked up the following official record:

**REFUELING COMPLETED** at advance base, crew awaits call from ground forces.

- **Hours flown,** 10,702
- **Troops transported,** 35,681
- **Wounded evacuated,** 1,571
- **Freight carried,** 283 metric tons

### Recent Record

These figures carry up to the early part of August. Since many of Boufarik's helicopters, notably the big S-58s, have been operating only since last May or June, it's better to look at a recent monthly record. Thus, in July, with some forty-odd helicopters available, including ten S-58s, the group's official record is as follows:

- **Hours flown,** 1,644
- **Troops transported,** 8,242
- **Wounded evacuated,** 417
- **Freight carried,** 44 metric tons

Incidentally, of the 1,644 hr. flown in July, 1,233 hr. represent actual operations in the field against the enemy.

A further study of the July operations reveals an interesting comparison between the work load of the S-55 and the S-58. During the month an S-55 carried 1,477 Commandos in 93 hours of flying time. By contrast, an S-58 carried 2,900 Commandos in only 86 hours of flying. Boufarik officers say the S-58s have been carrying from 10-12 Commandos at altitudes up to 6,000 ft.

Night missions are carried out only on emergency call. But some air force officials think certain day missions are a waste of money. They claim the ground forces are now so sold on helicopters that often the craft are used in areas where traditional foot slogging would be just as good, and a lot cheaper. "The ground forces just don't appreciate how much it costs to run these machines," complained one air force officer.

### Expensive

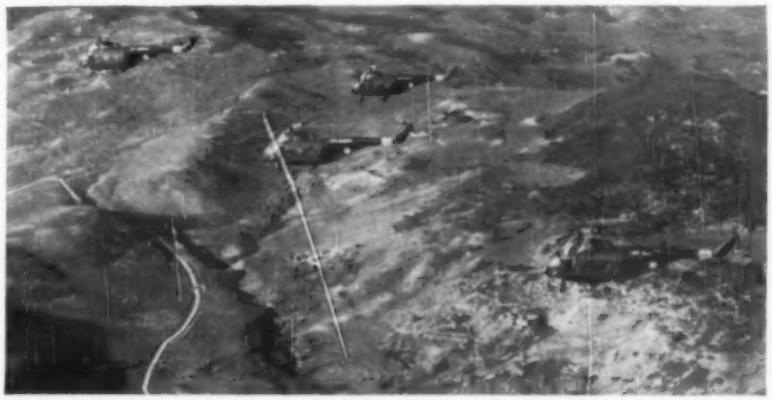
According to figures worked out at Boufarik, it costs about $85 an hour to operate a Bell; $285 an hour for a S-55; and $400 an hour for a S-58.

So far no helicopter operating out of Boufarik has been knocked down by enemy fire, though many have been hit repeatedly by small arms weapons. One S-55 at Boufarik, for example, has 32 bullet holes.

As a rule pilots wear flak vests, and the air force is planning to insert light armor plates under the pilot's seat and back rest. Seven out of ten hits enter the aircraft through the bottom hull. This is one reason why Boufarik S-58 pilots are glad the main fuel tank, located under the cabin, is self-sealing.

Unlike French army helicopter pilots, the air force pilots at Boufarik flew fixed wing aircraft before helicopters. Most of them have had 500-700 hours on either Ouragans, Mysteres or F-84s. (Back in France, however, many of the air force helicopter trainees

**AN AIR FORCE BELL,** built under license by Agusta of Milan, Italy, landing at Boufarik.



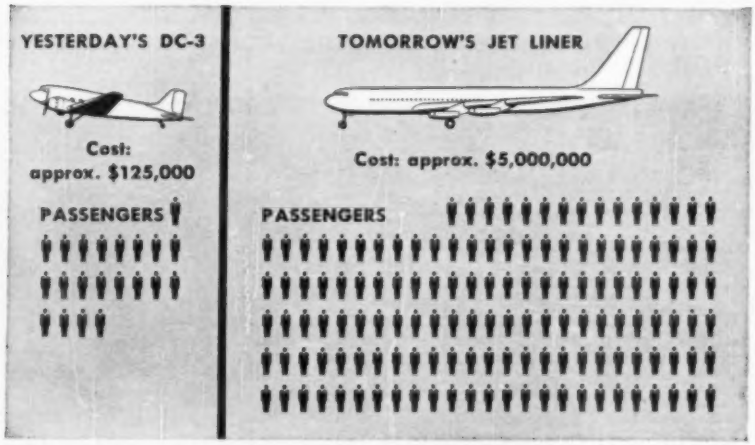
**FOUR S-55s,** on a mission from Boufarik, flying over rugged Bone area of Algeria.

**A BELL HELICOPTER** transports a litter case from battle area for treatment.

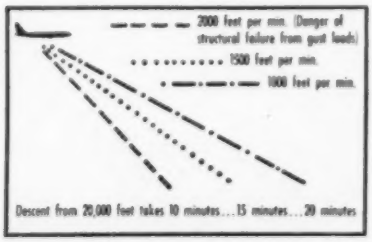
# Is your present safety program BIG ENOUGH for tomorrow's airliners?

*Compare your equipment . . . your passenger volume . . . your cost and risks of doing business today with 15 years ago. And tomorrow, the stakes will be even higher.*

**COMPARE YOUR INCREASE IN CAPITAL INVESTMENT AND RISK**




*Skydrol protects your capital investment and lessens your liability risks.*


2000 feet per min. (Danger of structural failure from gust loads)
1500 feet per min.
1000 feet per min.
Descent from 20,000 feet takes 10 minutes...15 minutes...20 minutes

The chart above proves what many pilots already know: To descend and land from high altitude takes so much time that fires in flight can be critically dangerous! You can lessen the possibility of these fires simply by replacing flammable hydraulic fluid with fire-resistant Skydrol . . . the world's only fire-resistant hydraulic fluid approved by the C.A.A. 4½ million flying hours' experience have proved Skydrol a better lubricant than mineral oil . . . extremely stable . . . can be re-used again and again and won't corrode metal. Conversion to Skydrol costs less than you think! For more information, write . . . *Organic Chemicals Division*, MONSANTO CHEMICAL CO., Dept. SKD-3, St. Louis 1, Missouri.

**34 MAJOR AIRLINES NOW USING SKYDROL**

| | | | |
|---|---|---|---|
| American | National | Delta | LAI |
| Braniff | Northeast | Slick | ANA |
| Continental | Panagra | JAL | Aramco |
| Flying Tiger | Western | PAL | U.S.A.F. |
| Pan American | Aigle Azur | CMA | B.O.A.C. |
| Canadian Pacific | Cathay Pacific | KLM | Northwest |
| North American Aircoach | Alitalia | LAN | Airwork, Ltd. |
| Trans-Caribbean | Swissair | TAI | Lasca |
| | United | UAT | |

*Skydrol: Reg. U. S. Pat. Off.*

**MONSANTO CHEMICAL COMPANY • ST. LOUIS, MISSOURI**

*Where Creative Chemistry Works Wonders For You*


have never flown before.) The Air Force trains its helicopter pilots from four to five months, giving them 100 hr. flying time. The S-58 pilots actually were trained at Boufarik, since the ships were sent there directly from the U.S.

Before flying the S-58s, the pilots put in 300 hr. on the S-55s.

Boufarik pilots deny reports that the S-58 needs a bigger and more solid landing area than the S-55. They claim they land 58s wherever a 55 goes in. In fact, pilots here says the 58 is easier to land than the 55. Additional power of the 58 holds a loaded ship in hovering position better than can be achieved by the 55. As one pilot put it: "With a 58 you can poke around all you want before sitting down."

Pilots at Boufarik are averaging 50 hr. flying time a month. When they go off on a mission, which usually lasts three days, they carry their own weapons, ammunition, bedrolls and rations.

Most of them speak enthusiastically about helicopters, particularly the S-58, and few appear anxious to get back to jets.

### Maintenance and Supply

The type of operation being carried out by the Boufarik helicopter group naturally involves special problems of maintenance and supply. For example, a ship has to be utilized so that it isn't operating in some remote region when its 150-hr. inspection falls due. Also the French have had to set up dozens of fuel dumps throughout Algeria.

Boufarik tech officers say 50-hr. and 100-hr. inspections are often pulled in the field while the aircraft is on mission. (This is not yet the case with the S-58.) For the 150-hr. inspection, the ship has to be brought back to the home base. For the 600-hr. inspection, or major overhaul, the ship usually is flown to the main Air Force maintenance installation at Maison Blanche, near Algiers, though some of this work is being done at Boufarik.

In general, technical personnel here say they've been maintaining their Sikorsky aircraft according to the company-supplied manual. Except for engine work, no major innovation has had to be made due to climate or operating conditions. The Agusta Bells are apparently no trouble at all to maintain.

At times, when a mission is being carried out in the Sahara region, special attention has to be paid to rotor heads so as to prevent sand and dust accumulation. But the rotor heads, the French say, are still serviceable at the 450-hr. red-line mark. No blade erosion is visible nor do the French complain of any.

A study of the Boufarik maintenance

charts shows that aircraft availability is as high as 70%. This is, however, more true for the Bells and 55s than for the S-58. The latter's availability is closer to 60% since the ship is new to mechanics and doesn't get turned around as fast as the others.

### Performance Data

As for average hours flown on a monthly basis for each type of ship, here's what the Boufarik performance chart shows:

- **Bell squadron,** 15 ships, 450 hr.
- **Two S-55 squadrons,** 16 ships, 1,100 hr.
- **S-58 squadron,** 10 ships, 400 hr.

The monthly average for the S-58 group is expected to increase as the ship becomes more familiar to pilots and ground crews. Actually, the 400 hr. listed above for the S-58 squadron is for the group's first full month of operation.

The one maintenance item not following the book is engine time. For the present, this problem concerns only the S-55s at Boufarik, type H-19D3, which are powered by an 800-hp. Wright.

While the book calls for engine change at the 600-hr. mark, here at Boufarik it's necessary to pull the engine at 300 to 350 hr.

French technical officers say the fault isn't with the engine, but rather with the use being made of it. Time and again S-55s have been overloaded with a resulting strain on the engine. The French, who naturally don't want to overload an engine, have discovered very often there's nothing they can do about it.

### Engine Overloading

A typical example of engine overloading took place recently not too far from Boufarik. Eight French legionnaires were cut off from their main column by a rebel band and by nightfall found themselves pinned down atop a mountain ridge. An S-55 discovered them with the aid of its searchlight.

The pilot landed close to the ridge on a small slope that dropped off into a steep ravine. The eight troopers climbed aboard but the load—double what it should have been for the altitude—ruled out a conventional takeoff. Shoving full throttle, the pilot "jumped off" the slope into the ravine, where he was able to pick up sufficient flying speed.

Naturally, the French admit, in operations like that one the engine takes a beating and can't be expected to live a normal life. But as the S-55 pilot said: "When I have eight to pick up, I can't stop counting at five and tell the rest to walk."

As for the 1,525-hp. Wright in the

*(Advertisement)*

# Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

**If you're looking for unequaled high-altitude performance in a fuel pump, better check Whittaker's Ratio-Flo unit.**

**A light-weight, small-envelope pump, it offers high positive displacement efficiency, and extreme simplicity.**

**Not only can it be used with any type engine—adapted to any convenient source of aircraft power—it can serve in any of several applications: As a proportional control device; as an engine feed pump or as a combined engine feed and proportioning unit: as a fuel transfer control or as an in-flight refueling pump.**

**The Ratio-Flo pump had its genesis in the flow divider developed several years ago by Whittaker's Del Phillips for the Douglas C-124C to deliver oil in equal amounts to each of two oil coolers. This was followed by a flow joiner unit and later by a small DC motor driven scavenging pump to pull out fuel trapped in the wing tanks of North American's F-100 Super Sabre.**

From these developments, Phillips' research engineers—primarily Dale Hartley—evolved the Ratio-Flo pump, recognizing the coming need for a unit that would offer reliability and efficiency at high altitude, not only for aircraft, but for missiles as well.

For those of you who are interested in a more technical description, here's the way a Whittaker engineer explains the hydraulically driven version of the pump:

"The assembly consists of a positive displacement pump connected directly to a positive fixed-displacement hydraulic motor. Pumping action is obtained by the rotary action of a sinusoidal-like waveform within a cylindrical cavity.

**"Inlet and outlet ports are defined by the action of an oscillating shuttle which seals the high and low pressure areas. A continuous flow is obtained in direct ratio to the speed of rotation and the discharge pressure is always a direct ratio of the input torque."**

Thus, constant fuel pressure is maintained within very close limits over wide-ranged flow conditions.

As for unmatched displacement efficiency, with the dual waveform rotor the pump can displace up to 135 percent of the pumping cavity with each revolution. This didn't sound right to me, either, so I checked it.

"That's correct," one of the engineers told me. "Say the cavity holds a quart. Then one rotor revolution might pump a quart and a pint. This phenomenon is due to the fact that the dual waveform rotor sweeps the cavity twice per revolution."

The unit can be adapted to either direct or alternating current, with minimum electric power input obtained by fixing the pump speed in accordance with the output flow and pressure requirements. Such operation, with almost any power source, requires only the matching of pump, motor and control characteristics.

The Ratio-Flo unit is only about one-half the size of equivalent pumps, due to high volumetric displacement efficiency, and can be provided to handle flows ranging from five gallons per minute to 200 gpm or better.

**Whittaker researchers have learned—for the benefit of the industry—that a fixed-volume hydraulic motor assures the lightest, most efficient method of obtaining variable speed control, for an optimum pressure-flow match is assured since a constant hydraulic input pressure gives a constant fuel pump discharge pressure and hydraulic flow varies directly as fuel flow.**

The amazing pump has other advantages, too. Its flows are non-pulsating. Because of its ability to pump air it will re-prime itself. It has a high vapor/liquid capacity. Hydraulically driven versions do not require relief valves. It operates equally well in either direction with the flip of a hydraulic selector valve. It will pump fluids with static pressures very close to the boiling point if velocities are reduced to a minimum.

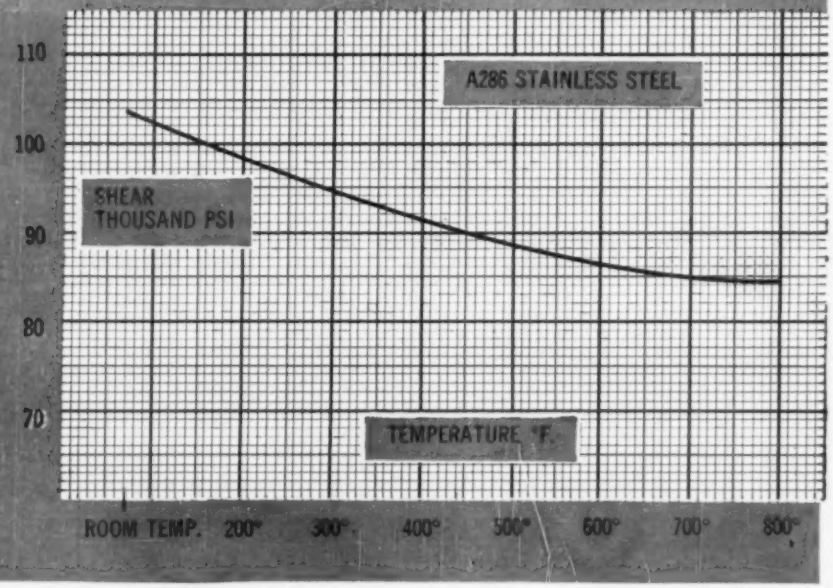
You may be curious, as was I, as to just how fuel proportioning is achieved.

"Merely by coupling hydraulic motors," the engineers explain, "two or more units can be installed to combine outputs in fixed ratio by connecting several motors in series. Since all the motors will turn at the same speed, all pumps will deliver the same flow rate. Then, too, several units of different capacities can be joined this way to obtain a wide range of flow ratios."

**All I can give you here is a quick sketch of the Ratio-Flo development, with the suggestion that if it's an efficient, light-weight, high-altitude pump you're needing—check Whittaker for technical details.**

# NOW, Cherry Rivet announces the

## ✓HI-STRENGTH
## ✓HI-TEMPERATURE
## "600" Rivet




Another new product by CHERRY RIVET research and development to meet the design requirements imposed by extremely Hi-Speed Aircraft and Missiles.

**Wide Grip Range • Positive Hole Fill**
**High Clinch • Uniformly High Pin Retention**
**Positive Inspection**

For additional data on the *new* Cherry "600" Hi-Strength, Hi-Temperature Rivet, write to Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

**CHERRY RIVET DIVISION**
SANTA ANA, CALIFORNIA
**Townsend Company**
ESTABLISHED 1816 • NEW BRIGHTON, PA.

**In Canada:** *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

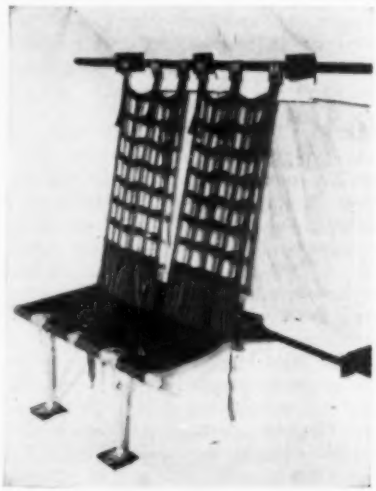

S-58, the French say they haven't logged enough engine time to know how the powerplant will stand up. But since the 58s aren't being pampered at Boufarik, it's not likely the engine will last a conventional life span.

The 260-hp. Lycoming on the Agusta Bell is lasting as long as the manufacturer said it would. This is mainly because the Bells, though used continually, are rarely overloaded.

For the moment, Boufarik represents the only Air Force helicopter base in Algeria. But Air Force officials talk of an expansion program that reportedly is under way; it is supposed to be completed early next year. At that time, the Air Force expects to have in Algeria 60 S-58s, 30 Bells and between 20-25 S-55s.

To prepare for this expansion the Air Force reportedly plans to set up two more helicopter bases in Algeria. Boufarik will continue to serve central Algeria, a new base at Oran will handle western Algeria, and a third base, as yet unlocated, will be created in eastern Algeria.

This expansion, of course, implies a break with the present system under which the Air Force operates in western Algeria while the Army flies its helicopters in eastern Algeria. Naturally, the Army is opposed to the move. In fact, the French Army doesn't like the idea of the Air Force transporting ground troops.

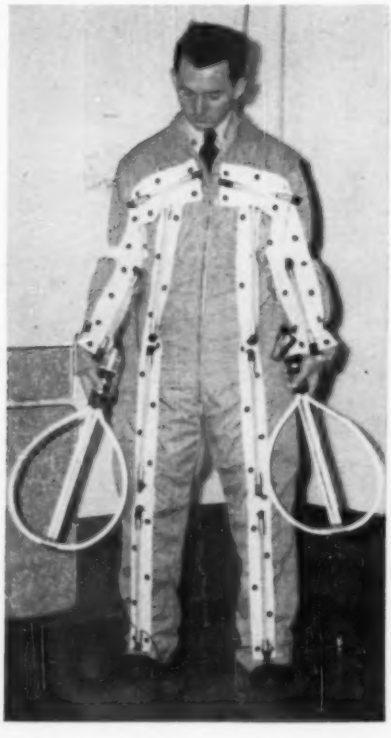


## New Troop Seat

This new, lightweight, foldaway troop seat has been developed by Kellett Aircraft Corp. to comply with military specification MIL-S-5804A. The seat can be stowed against the cabin wall when not in use, or it can be rolled into a compact package for storage. The seat has been approved by the Air Force, according to the manufacturer.

## Night Suit

Illuminated suit devised for use by British Navy "batsmen" guiding aircraft making night landings on carriers. Lighted suit (above) as it looks to pilot approaching carrier at night. Lt. Cdr. Stuart Soward (below), inventor of the suit, models it.



UTILITY UNLIMITED.....

KAMAN

THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.

Now in service with the U. S. Marine Corps, the Kaman HOK-1 is shown here as a cargo carrier. An all 'round utility helicopter, it is equipped with a hydraulic hoist for rescue missions. Carrying litters internally, it doubles as an aerial ambulance. Kaman is proud of the versatile role the HOK-1 is playing in our continuing program of National Defense.

ACCURATE—HIGH SPEED

TELEMETERING SWITCHES

LIGHT WEIGHT
RELIABLE
COMPACT

This new ASCOP model provides high quality switching of low level signals under extremes of shock and vibration. Withstands 50 G acceleration. The one pole wiper samples 60 contacts at 10 RPS and operates at low noise levels. ASCOP has the solution to any switch problem... over 200 available models for a wide variety of applications. A staff experienced in telemetering, instrumentation, data handling, etc. Rely on the leader...

APPLIED SCIENCE CORP. OF PRINCETON

P. O. Box 44, Princeton, N. J. • Plainsboro 3-4141

1641 S. LaCienega Blvd., Los Angeles, Calif.

Crestview 1-8870

ASCOP

WE PROVIDE THE LEVER | YOU MOVE THE WORLD

## to weight engineers

A. C. Robinson (left), weight group engineer in charge of research and development, discusses new solutions to problems involving effect of aerodynamic heating on structural weight with L. T. Maynard (center), Structures Division administrator, and Weight Engineer W. L. Weber.

## *who seek preliminary design assignments*

An important expansion in Lockheed's Weight Department has created a number of positions *on all levels* for Weight Design and Weight Engineers. The majority of the openings are in preliminary design phases of weight and include: weight balance prediction, preliminary design weight and balance estimation, weight reduction and weight control activities.

*These are the significant aspects of the openings:*

**1** Under Lockheed's Weight philosophy, Weight Engineers assume far more influence and responsibility during preliminary design stages than is customary at other companies.

**2** Because of Lockheed diversification, Weight Engineers work on virtually all types of aircraft in commercial and military fields.

**3** Promotional opportunities are extremely favorable because of the growing expansion in the Weight Department—and because of new functions now being assumed.

**4** Salaries have just been increased 6%.

Engineers who are convinced that Weight Engineering is one of the most important phases of aeronautical endeavor are invited to write E. W. Des Lauriers, Lockheed Dept. WE-3-8-2. Brief resumé form below is for your convenience in contacting Lockheed.

**Lockheed** *California Division*

E. W. Des Lauriers, Dept. WE-3-4-9
Lockheed Aircraft Corporation
Burbank, California

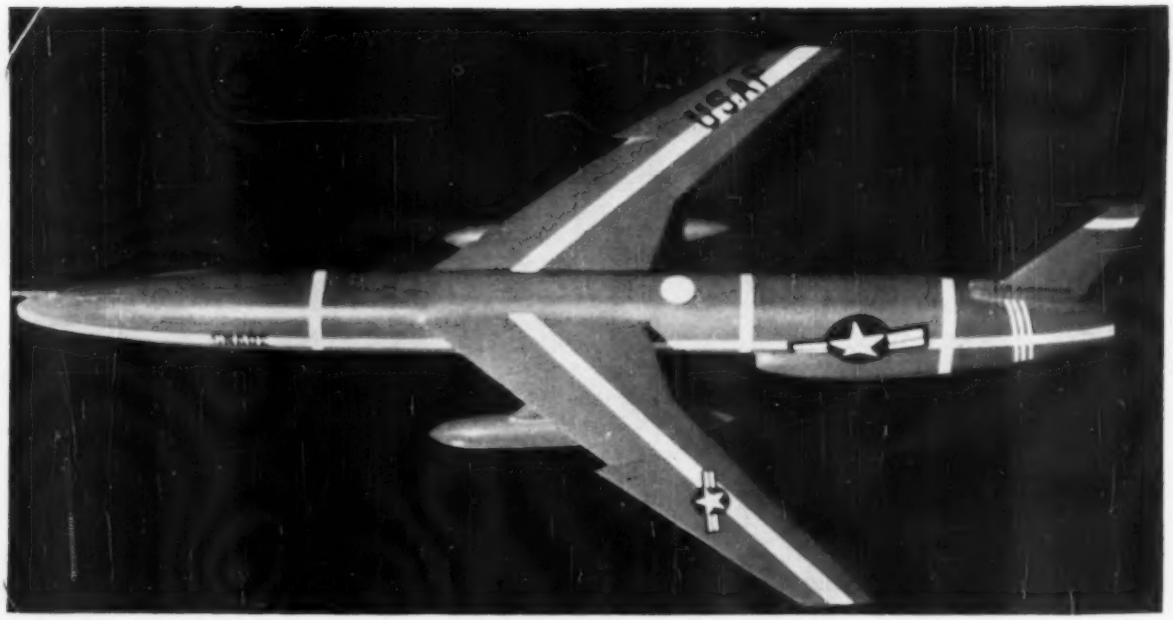
Dear Sir: Please send me your brochure detailing life and work at Lockheed

Name

If you are an engineer, please state your field of engineering

Home street address

City and State Home phone

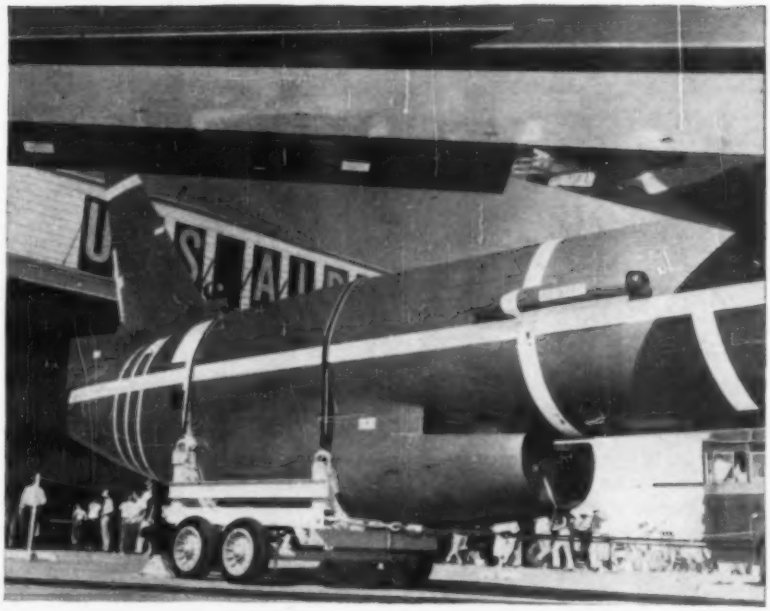


# Snark Details Viewed by Public At Aircraft Show

Pylon-mounted underwing auxiliary fuel tanks are featured on a scale model (top photo) of the Northrop Snark guided missile displayed at the National Aircraft Show, Oklahoma City.

Closeup (right) details intake of the XSM-62 Snark shown at the air pageant, also the rear portion of the two four-wheel dollies. The missile is zero launched. Early Snarks had the Allison J71; later versions have a P&W J57.

Thin airfoil with "sawtooth" leading edge is detailed below, left. View of the 74-ft.-long Snark (right) shows compartment, above jet exhaust, housing a parabrake used in Snark recovery. Snarks have underbelly and wingtip skids for landing.



*When Aviation Buyers Go to Market . . .*

*Be Sure Your Product or Service Is There*

# 1957 Aviation Week Annua

## *Aviation's Only Source for Complete Buying Information Offers Advertisers Exclusive Advantages*

- **SECTIONALIZED FORMAT FOR EFFICIENT USE BY BUYERS**

  Aircraft, Missiles, Supporting Groups, Nuclear Power Systems, Airlines Airports and Avionics sections are set up to provide a quick and ready locator for all products, companies and their advertisements.

- **BUYERS ARE DIRECTED TO ADVERTISEMENTS**

  Manufacturers' product listings are keyed to their advertisements through "see advertisement page" references.

- **ADVERTISER'S PRODUCT-LISTING BOLD FACE**

  Companies advertising in the Buyers' Guide are listed in Bold Face in the appropriate section.

- **READER SERVICE CARDS ARE KEYED TO ADVERTISEMENTS**

  It's an easy matter for buyers to request additional information about your product or service. Many thousands of reader inquiries have resulted from the 1956 Buyers' Guide, coming almost exclusively from engineering-management men, research scientists and top military men . . . the men who do Aviation's buying today.

- **YEAR-ROUND SELLING POWER ASSURED**

  Week after week, since the 1956 Buyers' Guide was published last December, reader inquiries have been streaming in and are still coming ten months later, even as the 1957 Buyers' Guide prepares to go to press.

- **AVIATION'S LARGEST ENGINEERING-MANAGEMENT AUDIENCE**

  The Annual Buyers' Guide is a special service issue which last year provided the industry with 592 pages of the latest detailed procurement information. Included were 37,500 cross-referenced company and product listings and 221 pages of advertisements describing manufacturers' products and services to aviation buyers across the United States and in 88 different countries. Aviation's largest audience of engineering-management men, research scientists and top military men – the men who do Aviation's buying today – will receive copies of the Buyers' Guide through AVIATION WEEK's circulation* (industry's largest) and through additional circulation gained through extra-copy orders from industry, the military and foreign countries.

- **SPECIAL DISCOUNTS ON MULTIPAGE AND CATALOG-TYPE SPACE**

  Your AVIATION WEEK representative will gladly help you plan your advertising to make most economical and resultful use of the BUYERS' GUIDE. CONTACT HIM OR WRITE AVIATION WEEK BUYERS' GUIDE, 330 W. 42nd St., New York 36, N. Y.

Published December 1956

*Average net paid ABC circulation December-June 1956 57,900
Paid circulation of current issue 62,905

Recent readership research by Advertising Research Foundation shows 1.4 readers for every subscriber copy of AVIATION WEEK's readership determined by personal interview using strict recognition test. Current print order copies 66,779.

a Buyers' Guide

ABP ABC AVIATION WEEK

A McGRAW-HILL PUBLICATION

# One of these days

## ... you'll be living in Southern California

If you're happy right where you are—if you like your job, your boss, your neighbor's children, the weather—then this message may be a little premature.

But if you sometimes suspect things could be better, then we'd like to tell you about the Southern California Cooperative Wind Tunnel, and about living in Pasadena.

We don't expect anybody to pull up stakes and move out here tomorrow. But if you're looking for more of the good things in life, both job-wise and otherwise, we think the CWT and Pasadena have a great deal to offer. No resume to send—just mail the coupon below for the CWT story.

**CWT**

*Operated by the California Institute of Technology. Owned by Convair, Douglas, Lockheed, McDonnell and North American.*

*CWT is concerned with testing, analysing and solving aerodynamic problems involved in the development of high-speed aircraft and guided missiles.*

**Southern California Cooperative Wind Tunnel**

*950 South Raymond, Pasadena, California*

**GENTLEMEN:** *Please send me literature about the Wind Tunnel.*

NAME_____

HOME ADDRESS_____

CITY_____ STATE_____


# Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices:

**REDSTONE ARSENAL, Huntsville, Ala.**

**Hayes Aircraft Corp.**, P. O. Box 2287, Birmingham, Ala., specialized services for manufacture of special tooling & fixtures (PR nr. CS-13078-56), job, est. $200000.

**CORPS OF ENGINEERS, U. S. ARMY, Office of the District Engineer, St. Paul District, 1217 U. S. Post Office and Custom House, St. Paul 1, Minn.**

**Gunnar I. Johnson and Son Co.**, 848 West 79th St., Minneapolis, Minn., construction of operations building addition at Air Force Stations Chandler, Wadena and Finland, Minn. (IFB ENG-21-018-56-16), job, Schedules I, II and III, $166358.

**SAN FRANCISCO ORDNANCE DISTRICT, 1515 Clay St., P. O. Box 1829, Oakland 12, Calif.**

**Stanford Research Institute**, Menlo Park, Calif., study of certain aspects of radiating antenna systems, contract DA-04-200-ORD-273, suppl 10, $41680.

**CORPS OF ENGINEERS, U. S. ARMY, Office of the District Engineer, Albuquerque District, P. O. Box 1538, Albuquerque, N. Mex.**

**C. H. Leavell & Co.**, 1900 Wyoming St., El Paso, Tex., construction of engineering building, White Sands Proving Ground, Las Cruces, N. Mex., contract no. DA-29-005-ENG-1732 (IFB ENG-29-005-56-92), job, $394201.

**CORPS OF ENGINEERS, U. S. ARMY, Office of the District Engineer, Walla Walla District, Bldg. 602, City-County Airport, Walla Walla, Wash.**

**Morrison-Knudsen Co., Inc.**, 319 Broadway, Boise, Idaho, constructing aircraft parking aprons and related work, Gowen Field near Boise, Ada County, Idaho (IFB ENG-45-164-56-35), job, $508738.

**J. H. Wise & Son, Inc.**, 900 E. Park Boulevard, Boise, Idaho, constructing four operations buildings and related work at Gowen Field near Boise, Ada County, Idaho (IFB ENG-45-164-56-36), job, $87821.

**CORPS OF ENGINEERS, U. S. ARMY, Office of the District Engineer, Nashville District, 306 Federal Office Bldg., Nashville, Tenn.**

**James W. Harris**, Clarksville, Tenn., construction of additional facilities for ordnance storage area at Clarksville Base, Tenn., (Chapel) (IFB ENG-40-058-56-31), job, $100465.

# Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

**NAVY DEPARTMENT, Bureau of Ordnance, Washington 25, D. C.**

**Emerson Radio & Phonograph Corp.**, Jersey City, N. J., engineering services on proximity fuse for guided missiles, NOrd 16897, $101,670.

**Eastman Kodak Company**, Rochester, N. Y., research and development in connection with guided missile fuse, NOrd 16985, $307,850.

**NAVY DEPARTMENT, Bureau of Aeronautics, Washington 25, D. C.**

**Van Zelm Associates, Inc.**, 7803 Pulaski Highway, Baltimore 6, Md., AT-3 catapults and spare parts, NOas 56-105-f (MA-4-5136-56), 15, $558,786.

**Minneapolis-Honeywell Regulator Co.**, 2600 Ridgeway Rd., Minneapolis 13, Minn., sets of special tools and test equipment for CN-51A/APS-31 gyroscope unit of radar set AN/APS-31, NOas 56-497-f (MA-43-5156-56), 6, $27,655.

**Stanford Research Institute**, Menlo Park, Cal., conduct a study to determine the

feasibility of developing a method for calculating metalworking equipment requirements for manufacturing reciprocating, turbocompound, turboprop and turbojet aircraft engines, NOas 56-608-c (IF-33-6037-56), $29,309.

**Somers Engr. Corp.,** 4810 Calvert Rd., College Park, Md., XJ-1A combination bomb rack and rocket launcher, NOas. 56-791-f (AR-45-4188-56), 8, $81,400.

**Goodyear Aircraft Corp.,** Akron 15, Ohio, kits of parts for modification of the sonar towing swivel pulley on ZSG-4 airships, NOas 56-2008-f (MA-30-4696-56 and 4708-56), 14, $28,091.

**DEPARTMENT OF THE NAVY, Office of Naval Research, Washington 25, D. C.**

**Clevite Research Center,** Cleveland 8, Ohio, research on flux responsive magnetic heads, job, $27475.

**Federal Telecommunication Labs,** Nutley 10, N. J., study and experiments on the properties of low and very-low frequency antennas, job, $25000.

**Hycon Eastern, Inc.,** Cambridge 42, Mass., research in digital computer reliability, job, $46652.

**AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia 11, Pa.**

**Utica Div., Bendix Aviation Corp.,** Utica, N. Y., parts for various A/C (383-2118-130-53), various, $210009.

**Vickers Inc.,** 1400 Oakman Blvd., Detroit, Mich., motor asys. for various A/C (383-2150-95-55), 133 ea, $48738.

**H. I. Thompson Fiber Glass Co.,** 1733 Cordova St., Los Angeles 7, Cal., blankets for FJ-3 A/C (383-2110-920-53, 383-2110-242-54, 383-2110-82-55), various, $32536.

**G. Felenthal & Sons, Inc.,** 3500 N. Kedzie Avenue, Chicago 18, Ill., computers & navigational slides, (383-2120-659X6-3-52), var., $36831.

**Benjamin Franklin Paint & Varnish Co.,** 4820 Langdon Street, Philadelphia 24, Pa., exterior paint, (IFB 383-1310-56), 12273 gal, $30987.

**Industrial Hard Chrome Plating Co.,** 1401 Park Ave., Emeryville 8, Cal., services & material, (383-23055153P1-56), 7500 ea, $276000.

**Houdaille Industries Inc.,** 537 E. Delavan Avenue, Buffalo 11, N. Y., dampers for various A/C (383-2150-1552X7-3-52), various, $38812.

**Rohm & Haas Co.,** 222 W. Washington Sq., Philadelphia, Pa., transparent plastic (IFB-383-1816-56), various, $121492.

**Bendix Products Div.,** Bendix Aviation Corp., South Bend, Ind., various parts & asys. (383-2150-2110-52), various, $59339.

**Alco Valve Co.,** 865 Kingsland Ave., St. Louis 5, Mo., control & arm asys. & parts (383-2110-2120-52), various, $35174.

**John J. Foster Mfg. Co.,** P. O. Box 2067, 19666 S. Harbor Blvd, Santa Ana, Cal., blankets for FJ-3 A/C (383-2110-920-53, 383-2110-242-54, 383-2110-82-55), various, $37585.

**McDonnell Aircraft Corp.,** Box 516, St. Louis 3, Mo., parts for F2H A/C (383-2110-2123-51), various, $52684.

**General Dynamics Corp.,** Conivar Div., 3165 Pacific Highway, San Diego, Cal., asys. & parts for R4Y-1 A/C (383-2110-141-54), various, $46001.

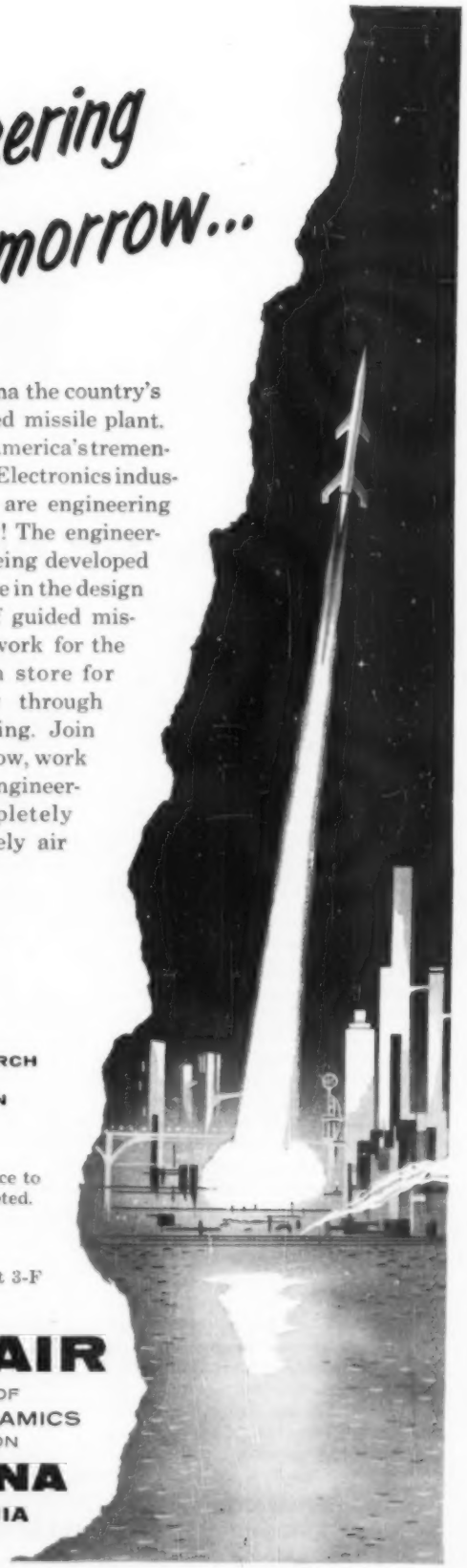
**Polarad Electronics Corp.,** 43-20 34th St., Long Island City 1, N. Y., test sets & radios (MIPR R-56-6004-SC-SMD-24), various, $288967.

**New York Rubber Corp.,** 100 Park Ave., New York, N. Y., life raft cases & repair kits (IFB 383-1305-56), various, $33568.


## ARDC Edition

A limited number of Aviation Week's special Air Research and Development Command Edition are now available at $3 per copy. Forward requests to Aviation Week, 330 West 42nd Street, New York 36, New York.





*Engineering for Tomorrow...*

...at Convair-Pomona the country's first exclusive guided missile plant. Here in the heart of America's tremendously fast growing Electronics industry, we at Convair are engineering for tomorrow today! The engineering miracles now being developed for America's defense in the design and manufacture of guided missiles is the groundwork for the fantastic future in store for America tomorrow through electronic engineering. Join the Convair team now, work in America's finest engineering facility. Completely modern... Completely air conditioned.

*Excellent opportunities now available in:*

**ELECTRONICS**
**AERODYNAMICS**
**DYNAMICS**
**THERMODYNAMICS**
**OPERATIONS RESEARCH**
**HYDRAULICS**
**MECHANICAL DESIGN**
**LABORATORY TEST**
**ENGINEERING**

Generous travel allowance to Engineers who are accepted. Write now enclosing a complete resume to:

Employment Department 3-F

**CONVAIR**
A DIVISION OF
GENERAL DYNAMICS
CORPORATION
**POMONA**
**CALIFORNIA**

WEAPONS ASSIGNMENT

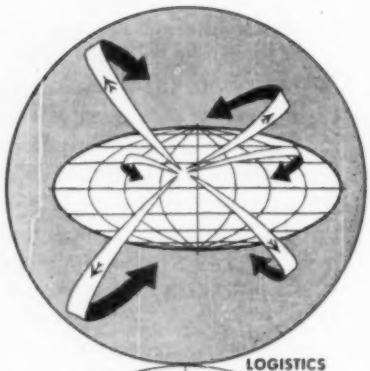
*at Hughes*

## NEW HORIZONS IN **DATA PROCESSING**

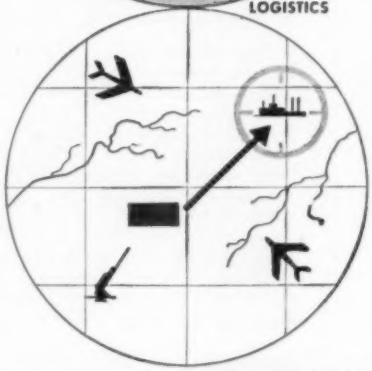
Hughes digital data processing systems are being used in the solution of one of our nation's most vital problems—defense against air attacks. In this age of atomic weapons and high-speed, high-altitude bombers, defense systems had to be developed which would supply anti-aircraft weapons with data on the position, speed, and direction of enemy planes. Hughes data processing systems surpass the most stringent requirements of modern anti-aircraft defense. Data may be received from many sources simultaneously; complex computing functions are carried out automatically; and data distribution is nearly instantaneous.

In the Hughes anti-aircraft defense systems, target information is received from radar stations. The system then accomplishes detection, identification, and tracking of enemy targets; storage and evaluation of the target data; and distribution of target and weapons assignment data to the anti-aircraft batteries. The batteries are thereby effectively coordinated in repelling the enemy attack. By linking together a number of such systems for the exchange of tactical information, a tight defense perimeter can be formed against aerial attack from any direction.

The contributions of the Ground Systems Laboratory have helped to make Hughes the West's leading center for advanced electronics. Hughes offers its Engineers and Scientists excellent salaries, constant challenge, and the luxury of Southern California living. For further information concerning the great opportunities at Hughes write us at the address below.



LOGISTICS



TARGET SELECTION

*Scientific Staff Relations*

*Research and Development Laboratories*

HUGHES AIRCRAFT COMPANY
*Culver City*
*California*

**HUGHES**

**Some of the openings include:**

**DEVELOPMENTAL DIGITAL CIRCUIT DESIGN ENGINEERS**

with experience in one or more of the following fields: pulse circuits, computer techniques, magnetic core devices, timing and synchronizing circuits, scalers, storage devices, analog to digital and digital to analog converters, and counting tubes.

**ENGINEERS AND PHYSICISTS**

for logical design of digital computer systems.

**ELECTRICAL OR MECHANICAL ENGINEERS**

experienced in the equipment design of digital computers. These engineers should be capable of working with schematic diagrams to design complete equipment packages. Knowledge of etched circuit design techniques is desirable.

**COMPONENT ENGINEER**

to select, evaluate or develop specialized components such as transformers, delay lines, capacitors, etc.

**DATA SYSTEMS ENGINEER**

to work on digital data processing in the area of storage memories and computer-type processing circuits.

**MICROWAVE ENGINEER**

for work on large high-gain antennas and transmission lines.

# WHO'S WHERE

(Continued from page 23)

**Dr. R. K. Roney**, head of newly formed Systems Analysis Laboratory, Hughes Aircraft Co., Culver City, Calif.; **Dr. Leonard Gross**, head-Missile Systems Analysis Department, and **Dr. Fred P. Adler**, head-Interceptor Systems Analysis Department, (departments within the new laboratory). Also: **Bernard E. Oldfield**, head-Flight Operations Department, Hughes' Guided Missile Laboratories.

**Fred Rauschenbach**, assistant weapons systems manager, Avion Division, ACF Industries, Inc., Paramus, N. J.

**Rear Adm. A. B. Scoles** (USN, ret.), operations manager, Litton Industries, Beverly Hills, Calif.

**H. P. Sparkes**, sales manager, Cole Electric Co., Culver City, Calif.

**J. P. Donald Garges**, sales manager, Curtiss-Wright Corp., Wright Aeronautical Division, Wood-Ridge, N. J.

**Thomas S. Teague**, manager of materials, manufacturing section, Metallurgical Products Department, General Electric Co., Detroit, Mich. Mr. Teague formerly was supervisor of the Malta Flight Propulsion Laboratory, General Electric's Aircraft Gas Turbine Division, Evendale, Ohio.

**Dallas V. Franke** to head new Advanced Development Department, LearCal Division, Lear, Inc., Santa Monica, Calif.

**Richard Haughton**, research analyst, Research and Planning Dept., Continental Air Lines.

**Clyde L. Councilman**, chief engineer, Air Associates, Inc., Teterboro, N. J.

**Richard H. Graham**, staff scientist for nuclear engineering, and **Dr. Frank C. Hoyt**, assistant director-research and head of general and nuclear physics division, Missile Systems Division, Lockheed Aircraft Corp., Van Nuys, Calif. Also: **Everett E. Christensen**, assistant flight test division engineer.

**Capt. Frank M. Briggs**, chief pilot, Latin American Division, Pan American World Airways. Capt. Briggs succeeds **Capt. Lewis C. Lindsey** who is returning to active flying. **Edwin B. Weissinger** is returning to the Latin American Division (industrial relations staff) after a three year assignment at PAA's Guided Missile Range Division, Patrick AFB, Fla. Also: **Eugene Perry**, district traffic and sales manager, Managua, Nicaragua.

**Gerald B. Speen**, senior member of technical staff, Federal Telecommunication Laboratories, San Fernando, Calif.

**Capt. Samuel P. Saint** will return to flying duties with American Airlines, Inc.; he is resigning from the Air Transport Association where he served as consultant-air traffic control planning.

**Karl D. Swartzel**, chief research and development engineer, Guided Missiles Division, Republic Aviation Corp., Farmingdale, N. Y.

**Douglas Hembrough**, Eastern regional manager, Pacific Scientific Co., Los Angeles, Calif.

**Russell L. Wageneck**, manager-operations, and **George L. Wysatta**, manager-sales promotion, Central Airlines, Inc.

**Michael S. Dayton**, assistant marketing manager, Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.

immediate 24 hour service
for transients . . . lowest price—fastest service
highest skilled workmen

**WE FINANCE MAJOR OVERHAULS**
**and save you money, too!**

Specialists on Douglas DC-6, DC-4, DC-3,
C-46, C-47, PBY and all executive aircraft.
Completely equipped station and shops.
Airframe, engines rebuilt, sheet metal,
electrical welding, custom interiors,
radio installation and repair.
**contract your maintenance at huge savings**
**send for our estimate on your next job.**
CAA approved station N 14011
Prime contractors on
airforce overhaul

**LONG BEACH AEROMOTIVE**
**Long Beach Municipal Airport, Long Beach, California / phone GArfield 4-8588**

**ENGINEERS, SCIENTISTS, DESIGNERS**

***Outstanding Opportunities Available***

The types of work on which you could be engaged include:

**Missiles**
**Applied Mechanics**
**Geophysics**
**Underwater Ordnance**
**Electronic Countermeasures**
**Digital & Analog Computers**
**Instruments and Controls**
**Solid State Physics**
**Microwaves & Antennas**
**Infra Red Systems**
**Inertial Systems**
**Servomechanisms**
**Balloon Systems**
**Industrial Automation**
**Upper Atmosphere Research**
**Fine Particle Technology**
**Surface Chemistry**
**Optics**
**Mechanical Design**
**Airborne Early Warning**
**Radar Systems**
**Information Theory**

**Systems Analysis and Design**
**Electronic Equipment Design and Miniaturization**

You can grow with our dynamic and progressive research and development activity in its long-term expansion. We are prime systems contractor for several major programs in which new groups are being formed and which create ground floor opportunities for you. We have excellent facilities and equipment and can use people to the fullest extent of their capacity, with encouragement and opportunity to advance further. You can work closely with prominent engineers and scientists. Our managerial positions are staffed by people with technical engineering backgrounds. You do not become isolated on a small part or component but contribute to and become an integral part of a significant program. Congenial associates and atmosphere. Our people tell us they **enjoy** their work, and our extremely low turnover rate testifies to this. Tuition re-imbursement plan includes University of Minnesota three minutes away. Delightful residential communities close to work, fine cultural environment, recreational areas, fishing, hunting, boating, winter and summer sports. Live in the Land of Sky Blue Waters. Permanent security with a stable, long-established company whose motto is "The Future is Our Frontier." Salaries recognize experience for all levels of positions. Relocation expenses. We believe we have all the opportunities you could find anywhere in the country.

*Engineers*—Electronic, Electrical, Aeronautical, Mechanical, Chemical
*Physicists, Meteorologists*, Physical and Electro *Chemists*
*Junior, Associate*, and *Senior* grades, from Bachelor through Doctorate degrees.

*All inquiries will be treated in complete confidence.*

*You are invited to address* **PETER BURGESS**, *Director of Personnel,*

**Mechanical Division of General Mills, Inc.,**
**1620 Central Ave. N.E., Minneapolis 13, Minnesota.**

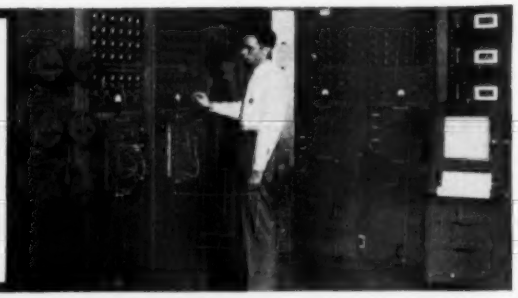
Bendix

# GUIDED MISSILES

## offer interesting jobs with outstanding futures

### SYSTEMS ANALYSIS

Engineers are needed to work on fundamental problems of analytical dynamics in missiles and weapons systems. Ability, training, and experience in analogue and digital computers, breadboards, prototype of missile equipment, and electronic and mechanical simulators are essential in these positions.



### ELECTRONIC GUIDANCE

Electronic Engineers with backgrounds in microwave, radar and servo systems are needed to design and develop guidance systems for a major guided missile project.

Mechanical Engineers are needed to design and develop electronic packaging for complex missile guidance systems.

### MISSILE SYSTEMS TEST

The whole is the sum of its parts. In our missile program, the high-caliber testing of the parts has an effect on the over-all missile performance. We want engineers with a good background in fundamentals who have experience in this systems type of testing.

Bendix Guided Missiles offer interesting job opportunities to Senior Engineers, Assistant Engineers, Junior Engineers and Technicians.

A thirty-six page book, "Your Future in Guided Missiles", describing in detail the many phases of our guided missile operation and the job opportunities available to you, will be sent to you on request. Write for your copy today. BENDIX PRODUCTS DIVISION—MISSILES, 406D, Bendix Drive, South Bend, Indiana.

***Prime Contractor for TALOS MISSILE***


*REPLIES (Box No.): Address to office nearest you*
*c/o This publication Classified Adv. Div.*
*NEW YORK: P. O. Box 12 (36)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*
*LOS ANGELES: 1125 W. 6th St. (17)*

### *POSITIONS VACANT*

**Miami, Fla.—Aerodynamicists, Stress Analyst** and Draftsman for 3 desirable positions in expanding Aeronautical Engineering School. Requires MS & 7 years aircraft experience. Salary to $10,000 for superior men under 35. Year round employment, 35 hour week, 4 weeks paid vacation. Send resume to Robert M. Williams, Director of Engineering, Embry Riddle School of Aviation.

**Experienced Pilot-Salesman, qualified multi-**engine. Technical background required. Interesting and challenging position with East Coast instrument and accessory manufacturer. Send resume to Box P-2927, Aviation Week.

**Aeronautical Accessory Sales Engineer with 5** years of sales accomplishments with major airframe companies, military centers, and airlines. Excellent salary for right man. Location in East. Resume and letter should reflect sales record. P-2933, Aviation Week.

**Instructor, Aeronautical Engineering: Univer-**sity of Southern California Aviation Safety Program. Require BS in AE and acquaintance with Rotary Wing Aircraft. Flying experience preferred. Full time teaching position at base salary of $8500.00, 30 day vacation and academic holidays. Time available for study or consultation service in industry. Send particulars to Aviation Safety Division, USC, Los Angeles 7, California.

### *SELLING OPPORTUNITY OFFERED*

**Fastener Salesman for California by Eastern** mfgr.: produce close-tolerance aircraft "specials-to-print" and A-N six-digit Bolts, Studs, Screws, etc. Commission. SW-2972, Aviation Week.

### *POSITIONS WANTED*

**Air Force contacts can be obtained for you** by experienced Dayton representative. PW-2792, Aviation Week.

**Pilot, ATR written, age 32, family, 4600** hours, 4 years executive DC-3, Twin-Beech, Mallard, desire captain position, state details first letter. PW-2860, Aviation Week.

**Scheduled Airlines Captain, Europe-based,** can be available shortly. Qualified DC-3, DC-4 and DC-6B. American, age 36. Brochure on request. Box PW-2965, Aviation Week.

**Pilot—ATR, DC-3 type rating 8000+ hours.** Wide experience all types. Prefer corporation type flying position. Age 40. Presently available. PW-2925, Aviation Week.

**Pilot ATR DC3 5500 Hrs. Multi-Engine sea** rating desires first pilot small twin or mallard preferably New York area will consider Co-pilot position of merit. PW-2998, Aviation Week.

**Aircraft Engineer (BS) 4 yrs Fluid systems** analysis experience, electronics technician experience, creative, capable. Desires to change to a more challenging opportunity with growth potential. Preferably in S F Valley or LA area. PW-2956, Aviation Week.


**Aviation Week**

**EMPLOYMENT ADVERTISING**

**contract rates per inch**

| | |
|---|---|
| 1"—$27.60 | 104"—$26.40 |
| 13"— 27.40 | 208"— 26.00 |
| 26"— 27.20 | 416"— 24.95 |
| 52"— 26.80 | 780"— 23.35 |

1560"—$21.55

An advertising inch is measured 7/8" vertically on one column, 3 columns to a page.

**Send new advertisements to N. Y. office, 330 W. 42nd St., N. Y. 36**

# OPEN DOOR *for open minds*

This is Litchfield Park, Arizona. Located 18 miles west of Phoenix, this ideal "vocationland" is a modern monument to the growth of Goodyear Aircraft. And a major factor in this continued growth and diversification is the freedom of creative thought and expression enjoyed by Goodyear Aircraft engineers.

Here, engineers know that *every* idea has a chance. And in transforming their ideas into realities, Goodyear Aircraft engineers find the stimulation of creative challenge and the satisfaction of realistic accomplishment.

If *you* are a creative engineer with faith in your ideas and confidence in your ability to make them work, here's your opportunity to become a part of this great creative team. For, because of our continued growth, we must expand our engineering staffs at both Litchfield Park and Akron, Ohio.

Assignments on a variety of highly significant projects are available to engineers in all specialties. The most modern equipment and facilities, including one of the largest computer laboratories in the world, permit application of the most advanced technology.

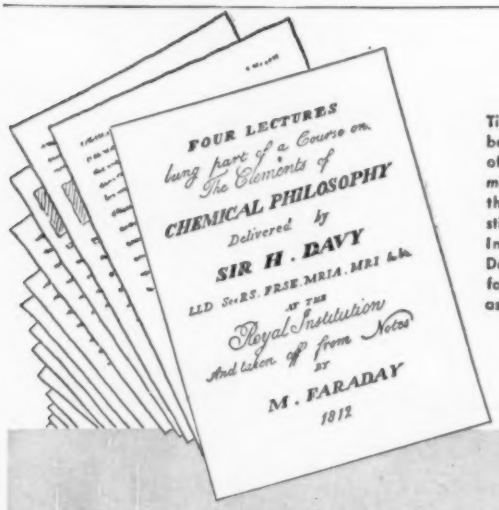
Salaries and benefits are, of course, liberal. And for those who wish to continue with academic studies, company-paid tuition courses leading to advanced degrees have been established at nearby colleges.

For further information on *your* career opportunities at Goodyear Aircraft, write: Mr. C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

***They're doing big things at***

**GOODYEAR AIRCRAFT**

THE TEAM TO TEAM WITH in AERONAUTICS




Title page of Faraday's beautifully illustrated set of notes that filled 386 *manuscript pages.* He sent the notes (which may still be seen in the Royal Institution Library) to Davy with a letter asking for a job as a laboratory assistant. (He got the job.)

# The application letter that ELECTRIFIED THE WORLD!

A set of tickets given young Michael Faraday, book binder's apprentice, not only admitted him to a series of lectures by Davy but opened the door to the Age of Electricity through his discoveries of the principles of the dynamo and the electric motor.

To men like Faraday who would like to associate themselves with eminent scientists, physicists and engineers, Farnsworth's doors are wide open. The genius that created electronic television continues to lead advances in radar; counter-measures; missile guidance; control, and test systems; industrial electronics; special purpose tubes; infra-red systems; solid state physics; electronic research, and production . . .

***ENOUGH HERE TO CHALLENGE A HUNDRED FARADAYS***

Your resume (it needn't be 386 pages) will receive prompt, confidential attention.

*Address Technical Employment Director*
**FARNSWORTH ELECTRONICS COMPANY, FORT WAYNE, INDIANA**
*A Division of International Telephone and Telegraph Corporation*

## GAMBLE?

*sure . . . if the odds are in YOUR favor . . .*

**DECISION/INC**—nationwide specialists in recruitment of engineering personnel—have an active and enviable record in developing job opportunities for men who want bigger salaries and a chance for greater personal achievement.

**DECISION/INC is retained by more top-ranking firms thruout the nation than any other organization to *find the right man* for each job. This confidential service costs you nothing.**

It takes TIME—MONEY—EFFORT to improve your job situation. If you are an engineer or scientist, particularly in the ELECTRONIC—AERO-NAUTICAL or GUIDED-MISSILE field, DECISION/INC will do this **quickly, effectively at no cost to you.**

**HOW?** Our placement specialist develops a plan "tailor-made" for you —which includes a resume of your experience . . . and then a review by selected companies leading to confidential interviews at **your** convenience and **our** client's expense.

***NOW is the time for DECISION!***
All **you** do **Now** is . . . send us your name, home address, job interest or title. We take it from there.

*Write or phone:*
**OLIVER P. BARDES,**
*President—*
**DECISION/INC**
**1460-72—FIRST**
**NATIONAL BANK BLDG.**
**CINCINNATI 2, OHIO**
**GArfield 1-1700**

*Publishers of the authoritative Engineers' Job Directory*

## PROJECT ENGINEERS
### Ground Handling Equipment

Challenging opportunity with midwestern Aircraft Company that needs one or more ground handling equipment Project engineers with several years experience in the design and development of Ground Support Equipment for Modern Jet Aircraft.

Applicants must be thoroughly familiar with the design of Trailer Mounted Air Conditioner Units, both gasoline engine and electrically powered, Trailer Mounted Aircraft Air Compressor Starter Units and other related types of ground support equipment.

**Liberal Salary and Benefits**

Unusual opportunity for self-starting engineers capable of spearheading projects of this type.

Please submit experience resume, salary expected and date of availability.

**P-2970,** Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

## CO-PILOT MECHANIC

Requires A & E Commercial and extensive D-18S mechanical experience. Multi-Engine and Instruments experience highly desirable. Aircraft based in New York Area. All replies Confidential.

**P-3020,** Aviation Week
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

***Don't forget the***

## BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

# ENGINEERS

Be certain *you*

**MAKE THE *RIGHT* CHOICE!**

**HAVE THE *RIGHT* JOB!**

## ASK YOURSELF THESE QUESTIONS —IT WILL PAY YOU.

CHALLENGING OPPORTUNITIES IN

- AVIONICS
- INERTIAL SYSTEMS
- COMPUTERS (Digital and Analog)
- MISSILE GUIDANCE
- JET ENGINE FUEL CONTROLS

with AC ELECTRONICS DIVISION OF

**GENERAL MOTORS Corporation**

Flint 2, Mich. and Milwaukee 2, Wis.

Whether a Recent Graduate making his first choice or a veteran Engineer seeking that permanently RIGHT position, ask yourself the following questions:

**MY TALENTS ARE BEST SUITED FOR?**

Engineers come all sizes, shapes and potentials. G.M.'s policy of decentralization creates individual opportunity for development and advancement.

**STARTING WAGE? POTENTIAL EARNINGS?**

At G.M. these two questions are best answered by another question—"How high is up?" Earnings both present and future are entirely dependent upon you. At AC you determine your earnings.

**PERMANENCY OF POSITION WITH AC?**

AC has been designated the official ELECTRONICS DIVISION for *all* General Motors Divisions. We are permanently dedicated to the research, development and manufacture of things Electronic . . . making America so it's safer and better.

**RESEARCH FACILITIES?**

At AC you enjoy working with the latest and the finest of equipment and with the top men in the field.

**LIVING CONDITIONS?**

Are the finest possible in Milwaukee, America's most progressive town combining big town cultural and civic advantages with small town hospitality. "An ideal town for ideal family living."

**WHAT CAN AC DO FOR ME?**

*Write us in strictest confidence . . . you will hear from us by return mail. Send us the coupon below . . . YOUR FUTURE DEPENDS UPON IT.*

AC The Electronics Division
General Motors Corporation, Milwaukee 2, Wis.

Send me full particulars about AC ENGINEERING OPPORTUNITIES

☐ So you can better "tailor make" your offer to me I have attached a resume of my education and/or work experience.

☐ I will send it at a later date.

Name_____

Address_____

City_____ Zone_____ State_____

## COMPUTING ENGINEERS
## APPLIED MATHEMATICIANS
(All Levels)

*New Opportunities in Republic Aviation's Expanding Computer Program*

A new, air-conditioned installation is under construction at Republic to house the equipment and personnel of its rapidly expanding Digital Computing Section.

Enjoy the opportunities that go with a wide range of complex problems in the design and manufacture of supersonic aircraft and guided missiles as we plan the progressive expansion of this installation in 3 phases. Positions are open at various levels, including supervisory.

You can capitalize on these opportunities if you have at least 2 years experience programming for digital computers, along with a sound background in mathematics—opportunities to enjoy varying degrees of responsibility where your knowledge of digital computing equipment, mathematical procedures and numerical techniques can be utilized for maximum efficiency.

*Please send resume in confidence to:*
**Mr. D. G. Reid**
Engineering Personnel Manager
**REPUBLIC AVIATION**
Farmingdale, L. I., New York

## VICKERS INCORPORATED
### OFFERS
## THE FOLLOWING OPPORTUNITIES

**AIRCRAFT SALES ENGINEER—SR. POWER PLANT SPECIALIST**

Engineering degree with knowledge of gas turbine engine—engineering or related accessories.

**AIRCRAFT SALES ENGINEER—SR. MISSILE SPECIALIST**

Engineering degree and experience with missiles or missile systems in the engineering or sales end.

**AIRCRAFT SALES COORDINATOR INSIDE COORDINATOR ENGINEER**

Engineering degree and experience with aircraft, aircraft engine, missile or general sales.

***Phone R. E. Barlow***
**Liberty 9-1122**
***or address replies to***

**VICKERS INCORPORATED**
Administrative and Engineering Center
Box 302 Detroit 32, Michigan

## OPPORTUNITY IN CENTRAL FLORIDA
### FOR ELECTRONICS AND ELECTRICAL ENGINEERS, PHYSICISTS AND MATHEMATICIANS

If you would like to bring your family to Central Florida to live in the sunshine all year around, away from the ice and snow of winter—where you can swim, fish, water ski and boat . . . where it costs less to live and there are more opportunities—then this is your once-in-a-lifetime opportunity.

We are a small growing company, owned and managed by engineers, with modern, newly-designed, well equipped laboratory located in the beautiful lake region of Central Florida. We have a limited number of openings for qualified creative and imaginative personnel for work on challenging projects in the Electronics Systems field. Salaries are paid commensurate with past experience and all engineers participate in Liberal Profit Sharing Plan. Moving allowances paid.

Submit complete resume giving details of past experience and educational background. Write:

***SYSTEMS SI INCORPORATED***
**2326 Diversified Way** **Orlando, 1, Florida**

## AERODYNAMICISTS
## DYNAMICISTS

Steady expansion of research and increasing production of military and commercial helicopters, convertiplanes, and other VTOL type aircraft projects has resulted in several staff openings for experienced aircraft engineers. Assignments include rotor analysis, flutter, stability and control, vibrations, development of performance methods, and programing of this work on digital and analog computers. Fixed wing experience applicable.

*Send resume to:*
**Manager Engineering Personnel**
**BELL** Aircraft Corporation
**Fort Worth, Texas**

# ENGINEERS AND SCIENTISTS

The Aircraft Nuclear Propulsion Department of General Electric invites you to join our professional staff currently engaged in advancing the state of the art, both in Cincinnati and Idaho Falls. Nuclear experience, though desirable, is not necessary.

Conventional training and experience can help solve the many unconventional problems met in atom-powered flight. Equipment has expressly been built to test out the original contributions of our staff, and some of the foremost men in atomic development are available for constructive group-thinking.

General Electric will promote your personal progress in all the ways for which it is famous throughout industry. Excellent starting salary.

## Join A Pioneer In The Coming Field of Atomic-Powered Flight

THE AIRCRAFT
NUCLEAR PROPULSION DEPT.
of GENERAL ELECTRIC

**Positions Open in Cincinnati, Ohio or Idaho Falls, Idaho**
**(at all levels of experience)**

STRUCTURAL • REACTOR • REACTOR DESIGN •
NUCLEAR • NUCLEAR POWER PLANT • ELECTRICAL • MECHANICAL •
ELECTRONIC • CHEMICAL • CERAMIC • FACILITIES •
AERODYNAMICS • PHYSICS • THERMODYNAMICS • PHYSICAL
CHEMISTRY • METALLURGY • MATHEMATICS

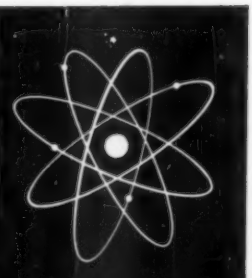
*Address reply in confidence stating salary requirements to the location you prefer*

Mr. J. R. Rosselot • P.O. Box 132 • Cincinnati, Ohio
Mr. L. A. Munther • P.O. Box 535 • Idaho Falls, Idaho

GENERAL ELECTRIC

# AVIONICS OPPORTUNITIES

*In Sunny, Tropical San Diego, California*



| | |
|---|---|
| SYSTEMS ENGINEERS | FOR **NEW** AIRBORNE NAVIGATIONAL SYSTEMS |
| SYSTEMS ANALYSTS (engineering and mathematics) | |
| CIRCUITRY DESIGN ENGINEERS | MISSILE GUIDANCE SYSTEMS |
| SERVO DESIGN ENGINEERS | |
| COMPONENT PACKAGING ENGINEERS (mechanical and electrical) | HELICOPTER INSTRUMENTATION |
| ETCHED CIRCUIT DRAFTSMEN | AIRCRAFT CONTROL SYSTEMS |
| MICROWAVE TECHNICIANS | |

Work on these challenging projects at RYAN
Live in beautiful San Diego—a year-round playground

WRITE TO JAMES KERNS, ENGINEERING DIVISION

**RYAN** AERONAUTICAL COMPANY
2711 Harbor Drive, San Diego 12, California

# TEST ENGINEERS

## *DO YOU LIKE YOUR ENVIRONMENT?*

Investigate the Environment created at AC for its Advanced Development Programs on Missile Guidance and Aircraft Fire Control Systems.

**OUR ENVIRONMENTAL LABORATORY**

is one of the most Versatile Laboratories in the country and is in the process of a Major, Permanent Expansion. Men hired will enjoy working with the finest of test equipment and facilities, together with top men of the field.

We are currently engaged in the following Types of Test Activities:

VIBRATION TESTING
COMPLEX WAVE ANALYSIS
LOW TEMPERATURE - ALTITUDE
HIGH TEMPERATURE
RELIABILITY EVALUATION
INSTRUMENTATION

*Write Mr. J. Heffinger*
*Supervisor of Salaried Personnel*

**AC**
**The Electronics Div.**
**General Motors Corp.**
**Milwaukee 2, Wis.**

# ENGINEER

***Does your present position contain any elements of these activities?***

- Mechanical Development
- Hydraulic and Servo Systems Design
- Stress and Vibration Analysis
- Instrumentation Engineering

A few openings for engineers with experience in these areas and the ability to apply their basic knowledge effectively to concepts in advance aircraft engine design and development.

These opportunities are outside the usual run of engineering positions, with well defined promotional possibilities in a department of a long-established company, where expansion has been continuous. Remuneration is commensurate with the advanced nature of the assignments. The engineer is accorded high professional status and there are additional benefits of satisfying nature. The location in a North-eastern resort area is marked by exceptional cultural and recreational advantages. The product offers stability in its appeal to both commercial and military markets.

*For further information write, giving details of education and experience in complete confidence to:*

**P-2720,** Aviation Week
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

# ENVIRONMENTAL ENGINEERS

Challenging opportunities in environmental research and development. Interesting assignments in the field of inertial navigation including:

Shock and Vibration studies
High and Low Temperature Investigation
Component evaluation

*Forward confidential resume. No reference contact without your permission.*

**Manager of Technical Personnel, Dept. 674**

**ARMA**

**Division American Bosch Arma Corp.**
**Roosevelt Field, Garden City, L. I., N. Y.**

**EXPANDING HELICOPTER PASSENGER PROGRAM HAS OPENINGS FOR:**

- Passenger Reservations Personnel
- Supervising Accountant and Auditor Statistician

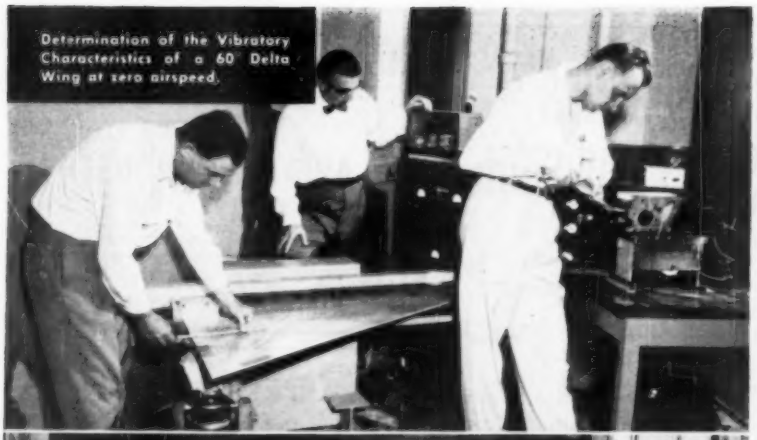
Airline Experience Required. Address Reply To:

**LOS ANGELES AIRWAYS, INC.**
Box 45155, Airport Station,
Los Angeles 45, California

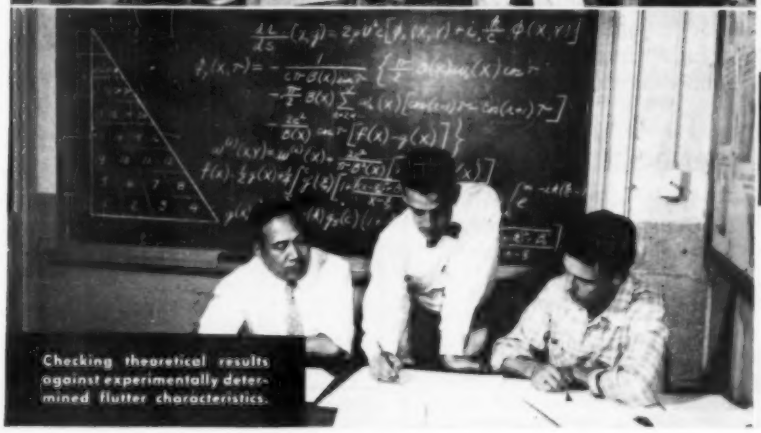
# HELICOPTER PILOTS & MECHANICS JOB OPPORTUNITIES AVAILABLE

Bell 47
Sikorsky S-55
Sikorsky S-58

**ROTOR-AIDS, INC.**
P. O. Box 1850 Ventura, California



Determination of the Vibratory Characteristics of a 60° Delta Wing at zero airspeed.



Checking theoretical results against experimentally determined flutter characteristics.

Wind tunnel tests on a multi-engine model produced sudden, violent flutter. A half-mile per hour increase in air-speed destroyed this model in 1/10 second.

# AEROELASTICITY

## AT CORNELL AERONAUTICAL LABORATORY

Our aeroelastic program is currently concerned with the transonic flutter of low aspect ratio wings, stall flutter of supersonic propellers operating at high angles of attack, and the dynamics of helicopter rotor blades. This program is a continuation of more than ten years of creative research effort in the field of aeroelasticity. New facilities will permit the extension of experimentation into the high temperature, high supersonic field.

The aeroelastic program is one of the many technical research programs currently in progress at C. A. L. We are now working on 160 different projects dealing with almost every area of research related to the challenging problems of modern flight. Electronics, materials, atmospheric physics, weapon systems, and applied mathematics are among the many stimulating areas of research available at C. A. L. for the professional man with an inquiring mind.

**CORNELL AERONAUTICAL LABORATORY, INC.**
**OF CORNELL UNIVERSITY**

The story behind Cornell Aeronautical Laboratory and its contributions to aeronautical progress is vividly told in a 68-page report, "A Decade of Research." Whether you are interested in C. A. L. as a place to work or as a place to watch, you will find "A Decade of Research" both useful and pertinent. Mail in the coupon now for your free copy.

W. V. DIEFENBACH
**CORNELL AERONAUTICAL LABORATORY, INC.**
Buffalo 21, New York

Please send me "A Decade of Research."

Name _____

Street _____

City _____ Zone _____ State _____

☐ Please send employment information.

# EXECUTIVE OPPORTUNITIES IN THE CESSNA SALES DIVISION

## REGIONAL SALES MANAGERS

- Executive management experience necessary in initiating and administering sales programs.
- Experience in supervising and directing a sales organization.
- Aircraft Background desired.

## REGIONAL SERVICE MANAGERS

- Travel out of and headquarter in Wichita.
- Aircraft maintenance background desirable.
- Must be competent pilot.

## PARTS MERCHANDISING MANAGER

- Must develop and administer a spare parts merchandising program.
- Must aid dealers in setting up and operating parts departments.
- Must have automotive parts experience on zone manager level.

**CESSNA**

**If you meet these requirements and are interested in an unlimited opportunity with the World's Leading Producer of Executive Aircraft, send your resume and recent photograph to the Professional Placement Supervisior, Dept. AW, Cessna Aircraft Company, 5800 East Pawnee Road, Wichita, Kansas. (No phone calls, please.)**

*High Professional Potential in*

# CONTROLS ANALYSIS

AT THE SMALL AIRCRAFT ENGINE DEPARTMENT OF GENERAL ELECTRIC

A whole new family of high-power—low weight turboshaft, turboprops and turbojet engines are in progress today at this G-E department following the recently revealed T-58 with its many unique engineering advances.

Control Systems as precedent-breaking as the new engines must be developed. And there are a number of rewarding opportunities for engineers with the ability to give this development a firm, analytical basis.

**Assignments include such operations as:**

**determining and specifying engine control parameters . . . providing performance specifications for systems and components . . . preparing data for analog computer studies . . . providing consultation service to Preliminary Design, Advanced Design and Project Groups . . . selecting and training control analysis personnel . . . and many other relative functions.**

Advancement comes rapidly to engineers who demonstrate their capacity in the important field of Control Analysis. This G-E department is itself expanding. The operation is decentralized. Management on-the-spot makes the decisions. Your contributions are quickly recognized and rewarded.

**GOOD STARTING SALARIES • RELOCATION EXPENSES PAID • ATTRACTIVE LOCATION • LIBERAL BENEFITS**

*Write in complete confidence to:*
Mr. T. S. Woerz (Section 1-B-2)
SMALL AIRCRAFT ENGINE DEPARTMENT

**GENERAL ELECTRIC**

1000 Western Avenue, West Lynn, Mass.

# SPECIAL SERVICES TO THE AVIATION INDUSTRY

## OVERHAUL & MAINTENANCE

**Remmert-Werner**

| Inc. of St. Louis | Inc. of Florida | Inc. of Toledo |
|---|---|---|
| Lambert Field | Pompano Beach Airport | Express Airport |
| Maintenance | Conversion | Overhaul |

Specialists in Lodestar **DC3** Beech

**CARTER AVIATION**
Byrd Airport, Richmond, Va.
C.A.A. Approved Repair Station No. 4260
Class 1 & 3 Airframe No Limitations
Power Plant Limited
AERO-COMMANDER SPECIALIZED SERVICE
By appointment only
P. O. Box 6097 Ph. Fairfield 4670

## PARTS & SUPPLIES

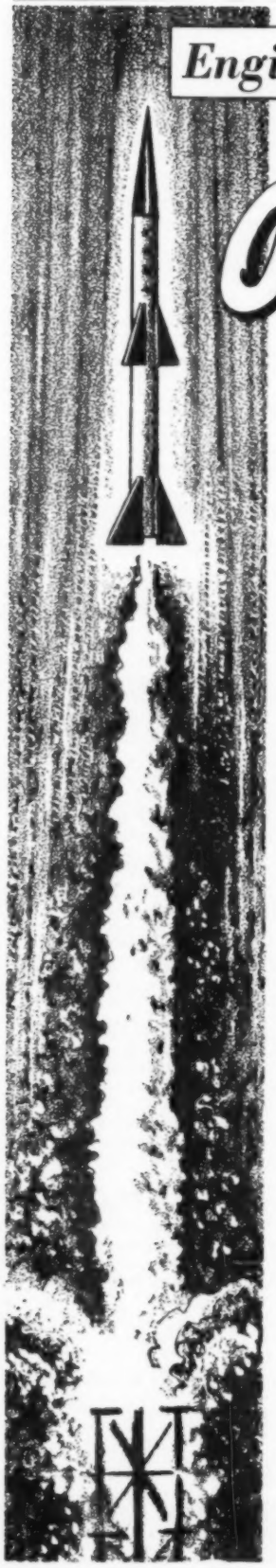
**NAVCO** INC. Lambert Field St. Louis, Mo. PErshing 1-1710
Has all Parts and Supplies for Executive DC-3 LODESTAR BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
P&W Continental Wright Goodrich Goodyear

**CONNECTORS**
STOCK DELIVERY — AUTHORIZED DISTRIBUTOR
BENDIX CANNON IPC WINCHESTER
2102 Market St., Phila. 3, Pa., LO 7-5285
HAROLD H. POWELL CO.

**OXYGEN EQUIPMENT**
SALES & SERVICE
REGULATORS — MASKS — VALVES
PORTABLES & CYLINDERS
FIXED INSTALLATIONS
GOV'T. APPROVED REPAIR STATION
**ZEP AERO** Phone: ORegon 8-1161 EL SEGUNDO, CALIFORNIA

## PROFESSIONAL SERVICES

KIRBY AND COPE ASSOCIATES
HUMAN FACTORS
Consultation on the design and utilization of mechanical and electrical equipment to suit man's physiological and psychological capabilities. Specialists in the cross-application of physical science and engineering with biology, medicine and psychology.
1515 Ramblewood Road Baltimore 12, Md.
Tel. ID 3-3609 or PE 2-8839



## *Engineers • Physicists*

# On The Way UP!

● Planned progress is the key to success for an individual as well as a business.

● Here at BURROUGHS we know where we are going . . . our course is charted and, like such advanced Intercontinental Ballistic Missiles as ATLAS and TITAN, we too are on the way up!

*More than 1,600 people and in excess of 200,000 square feet of working space in our four centers, located in the Paoli area, testify to our progress since 1954.*

● If YOU are an Engineer or Physicist . . . ON THE WAY UP . . . why not make the ascent with us in the creation and development of the advanced new computer techniques which will be required to control the course, speed and altitude of such Intercontinental Ballistic Missiles as ATLAS and TITAN as they are propelled out into space beyond the earth's atmosphere?

● Sage . . . ICBM . . . are just a few of the many government projects under way at BURROUGHS RESEARCH CENTER where, and equally important, untold time and creative effort is also being spent by our scientists on new and better ways to improve the business machines which have given BURROUGHS the right to use the slogan:

## THE *Foremost Name* IN COMPUTATION

### To Meet Tomorrow's Challenges Today

*Burroughs Invites Inquiries from Those Qualified As:*

- ELECTRICAL ENGINEERS
- ELECTROMECHANICAL ENGINEERS
- MECHANICAL ENGINEERS
- MECHANICAL DESIGN ENGINEERS
- MATHEMATICIANS
- PHYSICISTS

*. . . in the following fields — Control Computers, Pulse Circuitry, Digital Computers, Optical Devices, High Speed Mechanisms, Guided Missiles, Solid State Circuitry, Electronic Packaging, Electrographic Recording Devices, Printed Circuit Development.*

*Write or Telephone* **M. E. JENKINS,** *Placement Manager*

**Burroughs**
CORPORATION
**RESEARCH CENTER**
Paoli, Pa. Paoli 3500

*Near Historic Valley Forge*

# Engineers

## CONTINENTAL

### OFFERS YOU A WIDE FIELD FOR SPECIALIZATION

**Steady expansion of both research and production facilities at Continental Aviation & Engineering Corporation creates an increasing demand for qualified engineering personnel. Liberal salary benefits and a wide range of project activities on all phases of reciprocating and turbine engine development are yours when you join the Continental staff. . . . If you hold a degree in engineering, physics or mathematics, contact CAE at the address below and investigate the opportunities that can be yours.**

**ADDRESS: "Salaried Personnel"**

**CONTINENTAL AVIATION & ENGINEERING CORPORATION**
1500 ALGONQUIN AVE., DETROIT 15, MICHIGAN
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

## *Take command of your future*

## *FLY AS A* CO-PILOT *WITH* TWA

Your future is yours to command when you fly as a TWA co-pilot. You'll be flying the world's finest equipment with the world's finest airline.

JUST LOOK AT THESE ADVANTAGES — starting salary of $400 from first day of training; beginning with the third year, co-pilots receive monthly base pay and guarantee of 60 hours of flight pay; annual sick leave; paid vacation; liberal free transportation for you and your family each year; retirement plan; group insurance and many more.

QUALIFICATIONS: Aged 22 to 30; between 5'8" and 6'2"; can pass TWA physical. Must have: 400 hours total pilot time; CAA Commercial Certificate and sufficient instrument time to qualify for Instrument Rating. Two years of college or equivalent; Radio Telephone Permit Third Class

There's a wonderful future waiting for you with TWA. Get your letter off today to: Mr. R. Paul Day, Employment Manager.

***TRANS WORLD AIRLINES***
***MUNICIPAL AIRPORT***
***KANSAS CITY, MO.***


## SEARCHLIGHT SECTION

*(Classified Advertising)*

BUSINESS OPPORTUNITIES
EQUIPMENT - USED or RESALE

**UNDISPLAYED RATE**

**$2.10 a line, minimum 3 lines.**

**To figure advance payment count 5 average words as a line.**

*Box Numbers* — Count as one line. Replies mailed same day received.

*Discount* of 10% if full payment is made in advance for 4 consecutive insertions.

**DISPLAYED RATE**

The advertising rate is $21.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

*An Advertising inch* is measured ⅞" vertically on one column. 3 columns—30 inches—to a page.

*New Advertisements.* Address copy to Aviation Week, classified division, 330 W. 42 St., New York 36.


# DC-3
## FOR SALE

We are owners.

**LEEWARD AERONAUTICAL SALES, INC**
P.O. BOX 233, MIAMI 48, FLA.

**GRUMMAN MALLARD J-29**
Now being overhauled
Will finish to specifications

**1953 BEECHCRAFT D-18S**
Executive—one owner—only
700 hours—$55,000

**1948 BEECHCRAFT D-18S**
Clean & ready to go—$37,000

**WILLIAM C. WOLD ASSOCIATES**
Dept. AW-551 Fifth Avenue, N. Y. 17, N. Y.
*Telephone:* MUrray Hill 7-2050—*Cable:* Billwold

**OFFERING CIRCULAR**

(This does not constitute an offer for sale in the states where this security has not been qualified)
75,000 Shares of $1.00 par value fully paid and non-assessable.
Common Stock of APOSTOLESCU UNIVERSAL HELICOPTER COMPANY Incorporated is hereby offered for sale at $2.00 per share.
55 West 42nd Street, New York 36, N. Y.
LOngacre 5-5927

**UNUSUAL OPPORTUNITIES**

can be found each week in the

**SEARCHLIGHT SECTION OF AVIATION WEEK**

## Beechcraft Super 18

Well equipped Model E-18S available for immediate delivery. This airplane was placed in service 1955 and has a total time of 790:00. Left engine 490:00; Right engine 60:00. Replacement cost $138,000.00. Priced for quick sale—

*For details, call or write*

**ATLANTIC AVIATION CORPORATION**
Teterboro Airport — Teterboro, N. J.
Phone: ATlas 8-1740

## C46—CARGO—FOR SALE

R2800 Engines — Hamilton Props.
Low Time — Available Immediately

**TACA Airways Agency, Inc.**
Moisant Airport
Kenner, Louisiana

## 5 C46's

**FOR SALE OR LEASE**

IMMEDIATE DELIVERY "AS IS"
OR
WILL LICENSE CAA 4B

TRANSPORT SPECIFICATIONS
CARGO OR PASSENGER
FIRST DELIVERY 10 WEEKS
ONE EACH 2 WEEKS THEREAFTER

**RANSA AIRLINE**
P.O. BOX 625 MIAMI 48, FLA.
E. E. JONES — TUXEDO 8-6743

WANTED:

## TWIN BONANZA

Midwest company interested in buying Twin Bonanza—Prefer C-50 with good equipment and low time.

W-3016, Aviation Week
520 N. Michigan Ave., Chicago 6, Ill.

## AIRPLANES WANTED

Need 50 Bonanzas, Navions, 180's, 190's, 170's, Aero Commanders, Twin Navions, Twin Beeches, etc.
Will Buy Dealers' Stocks New or Used

**Vest Aircraft Co.'s Skyranch**
BOX 5305, DENVER 17, COLORADO

WANTED

## CONVAIR 240 or 340

Send Complete Information and Price to—

W-2308, Aviation Week
1125 W. 6th St., Los Angeles 17, Calif.

WORLD'S FOREMOST

## LODESTAR

SERVICE CENTER

| | |
|---|---|
| Inspection | Radar |
| Maintenance | Interiors |
| Instrumentation | Engine Change |
| Modification | Exteriors |
| Overhaul | Radio |

## LEAR

AIRCRAFT ENGINEERING DIVISION
Santa Monica Airport, Santa Monica, California
Builders of the Incomparable Learstars

FOR SALE

## C-46 A CARGO

Now operating outside U.S.A.
Terms Available—will consider lease
we own this aircraft

**NATIONAL AERO LEASING CORPORATION**
P. O. Box 184 — Miami 48, Fla.
Cable: Airland — Newton 5-0734

Deal Directly with Owner

## C18 and D18 BEECHCRAFT FOR LEASE

No deposit required—no long-term contract.

- Executive appointments
- Well equipped radio
- Full instrumentation
- Good selection

$800 monthly and up. Fly all you like. Aircraft hull insurance included. If desired aircraft available for outright purchase

**TRADE-AYER COMPANY**
Linden Airport — Linden, N. J.
Hunter 6-7690

## DC-3

**FOR LEASE**

Standard Airline Radio
21-Passenger interior
Complete Anti-icing, De-icing

**LEEWARD AERONAUTICAL SALES, INC.**
P. O. Box 233, Miami 48, Fla.

another exclusive offering!

## 24-Passenger Airline C-47's

Available for Immediate Sale
Delivery Early November
In Foreign Scheduled Airline Operation
Price asking $110,000
"as is"—"where is"
In excellent Condition

*For details contact:*

**William C. Wold Associates**
*(Exclusive Sales Agents)*
551 Fifth Avenue, New York 17, N. Y.
Telephone: MUrray Hill 7-2050
Cable: BILLWOLD, N. Y.

## HELICOPTERS

## HILLER

## UH-12B

*Available For*
LEASE PURCHASE,
SALE OR TRADE

**TRANS-INTERNATIONAL AIRLINES, INC.**
P. O. Box 233 — Miami 48, Florida

## HELICOPTER

Hiller—Model UH-12B. Very low airframe and engine time.

*Perfect Condition.*

EAST COAST AVIATION CORPORATION
Bedford Airport — Lexington 73, Mass.

*REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.*
*NEW YORK: P. O. Box 12 (36)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

*Wanted*

**Wanted. Mallard arranged for corporation use** or government surplus. Also Grumman Goose W-3015, Aviation Week.

ANYTHING within reason that is wanted in the field served by Aviation Week, can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

RAS INCORPORATED

## "Take a Heading for Reading"

*for the BEST MAINTENANCE • OVERHAUL • MODIFICATION • INSTALLATION*

**READING AVIATION SERVICE, INC.**
Municipal Airport — Phone 3-5255 — Reading, Pennsylvania

SINCE 1937

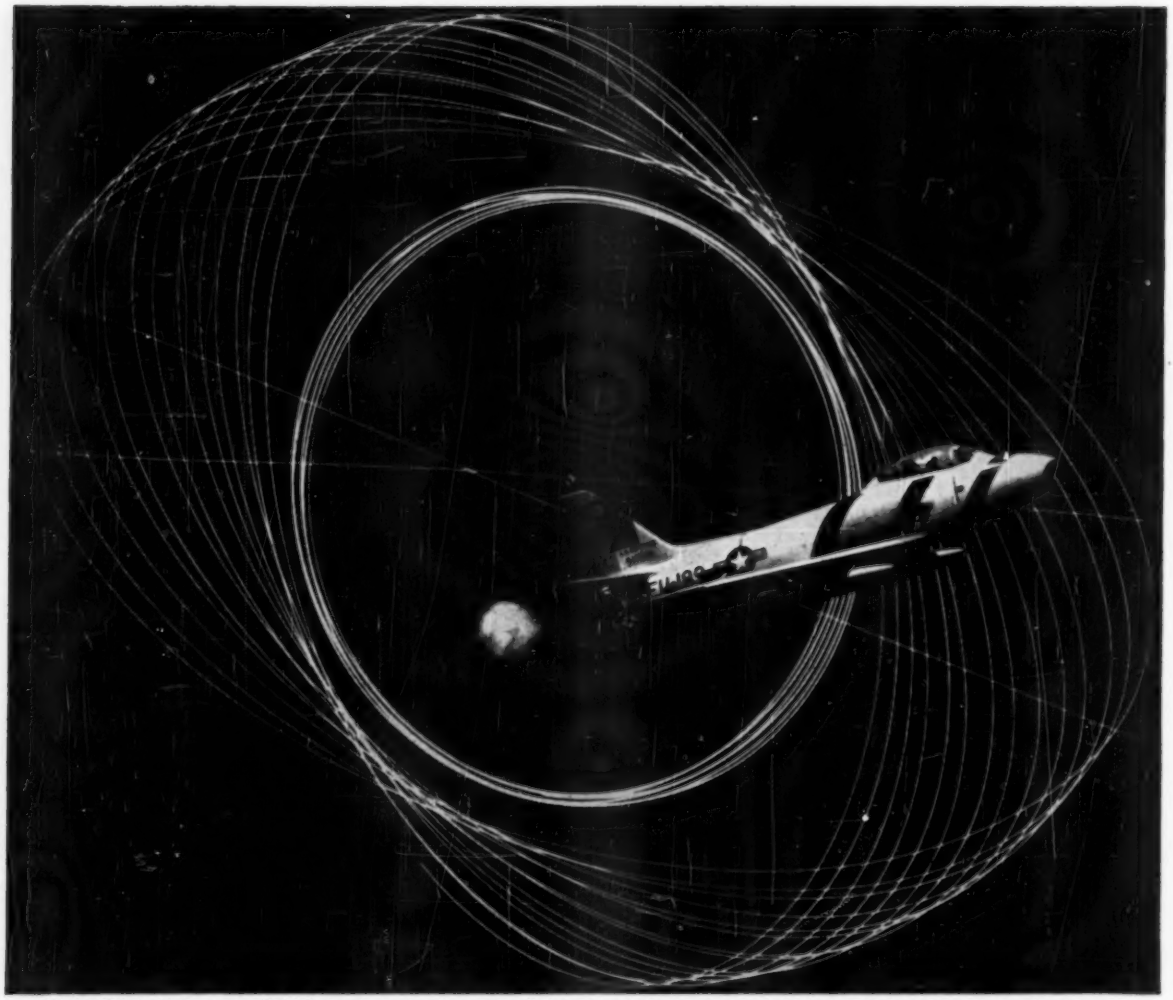
## Page AIRWAYS, Inc.

## FINEST AIRCRAFT MAINTENANCE

100 HR. INSPECTIONS
COMPLETE OVERHAUL

TWIN BEECH
DC-3
LODESTAR

ROCHESTER AIRPORT
PHONE GENESEE 7301 • ROCHESTER 11, N.Y.



A jet outfitted with AUTONETICS Flight Test equipment emits smoke puffs from special wingtip pods — air markers for checking a control system's accuracy.

# Flight test...the judge and jury

## *of tomorrow's electro-mechanical air crews*

It is quite a challenge to develop and produce automatic control systems for aircraft that—as yet—exist only in the minds of design engineers. But to test these systems—at the hypersonic speeds and extreme altitudes where they must finally operate—is equally difficult.

This is one of the jobs AUTONETICS is doing for the Department of Defense. To do it has required the development of ingenious flight test techniques. With a large and varied fleet of planes—ranging from subsonic craft to supersonic jets—AUTONETICS engineers put projects on trial under conditions that are dress rehearsals of tomorrow's tactical situations.

Yet that's only part of the story. These control systems are already far in advance of accuracy and precision standards available in existing test equipment. So AUTONETICS Flight Test experts have devised special instrumentation and intricate new data gathering systems that, in themselves, constitute a whole new concept of test techniques and procedures.

This is only one reason why AUTONETICS—in ten short years—has become a recognized leader in the production of flight controls, autonavigators, weapons director controls, computers, and other automatic control systems.

For more detailed information—or for employment in this challenging and growing field—please write: AUTONETICS, Dept. W-6, 12214 Lakewood Boulevard, Downey, California.

**Autonetics**

A DIVISION OF NORTH AMERICAN AVIATION, INC.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE

# ADVERTISERS IN THIS ISSUE

AVIATION WEEK—SEPTEMBER 24, 1956


ADVANCED PRODUCTS CO., THE ..... 78
Agency—E. J. Lush, Inc.
AEROQUIP CORPORATION ..... 8, 9
Agency—The Fred M. Randall Company
AMERICAN PHOTOCOPY EQUIPMENT CO. ..... 53, 54
Agency—Irving J. Rosenbloom & Associates, Inc.
APPLIED SCIENCE CORPORATION OF PRINCETON ..... 93
Agency—Paul M. Healy Adv.
AUTONETICS DIV. NORTH AMERICAN AVIATION INC. ..... 114
Agency—Batten, Barton, Durstine & Osborn, Inc.
AVRO AIRCRAFT LIMITED ..... 82, 83
Agency—Cockfield, Brown & Co. Ltd.
AVIATION WEEK ..... 76, 77, 96, 97

BASCH COMPANY GEORGE ..... 55
Agency—Davis, Parsons & Strohmeier, Inc.
BEECH AIRCRAFT CORP. ..... 71
Agency—Associated Advertising Agency, Inc.
BOURNS LABORATORIES ..... 4
Agency—Allen, Dorsey & Hatfield, Inc.
BRISTOL ENGINEERING CORPORATION ..... 52

CESSNA AIRCRAFT COMPANY ..... 56
Agency—Gardner Advertising Co.
CHANDLER-EVANS COMPANY ..... 18
Agency—Hugh H. Graham & Associates, Inc.
COLOR TELEVISION, INC. ..... 64
Agency—Sturges & Associates
COLUMBUS DIV. NORTH AMERICAN AVIATION, INC. ..... 66
Agency—Batten, Barton, Durstine & Osborn, Inc.
CONVAIR A DIV. OF GENERAL DYNAMICS CORP. (SAN DIEGO DIV.) ..... Second Cover
Agency—Buchanan & Co., Inc.
CONVAIR A DIV. OF GENERAL DYNAMICS CORP. (POMONA DIV.) ..... 99
Agency—Pacific Western Adv. Agency

DOW CHEMICAL COMPANY (FOUNDRY SALES) ..... 57
Agency—MacManus, John & Adams, Inc.
DOW CORNING CORPORATION ..... 16
Agency—Church & Gribseville, Adv., Inc.

EDISON, INC., THOMAS A. (INSTRUMENT DIV.) ..... 14
Agency—Gaynor, Colman, Prentis & Varley, Inc.
EDO CORPORATION ..... 62
Agency—Davis, Parsons & Strohmeier, Inc.
ELASTIC STOP NUT CORP. OF AMERICA ..... Fourth Cover
Agency—G. M. Basford Company
ELECTRICAL ENGINEERING & MFG. CORP. ..... 35
Agency—West-Marquis, Inc.
ELECTRO-SNAP SWITCH & MFG. CORP. ..... 15
Agency—Stoetzel & Associates, Inc.
ELECTRONICS CORP. OF AMERICA (FIREYE DIV.) ..... 84
Agency—Horton-Noyes Co.

FAIRCHILD ENGINE & AIRPLANE CORP. ..... 3
Agency—Gaynor, Colman, Prentis & Varley, Inc.
FENWAL, INC., AVIATION PRODUCTS DIV. ..... 10, 11
Agency—James Thomas Chirurg Co.
FLIGHT REFUELING, INC. ..... 71
Agency—Davis, Parsons & Strohmeier, Inc.
FLOW CORPORATION ..... 80
Agency—Frederick W. Cole Adv.

GARRETT CORP. (AIRESEARCH MFG. DIV.) ..... 80, 81
Agency—J. Walter Thompson Co.
GENERAL ELECTRIC COMPANY ..... 48, 49
Agency—G. M. Basford Company
GOODRICH CO., THE B. F. (AVIATION PRODUCTS DIV.) ..... 20
Agency—Batten, Barton, Durstine & Osborn, Inc.

HAMILTON STANDARD DIV., UNITED AIRCRAFT CORP. ..... 115
Agency—Chambers & Wiswell, Inc.
HOLLEY CARBURETOR CO. ..... 12
Agency—Holden Chapin-Lavin, Inc.
HUGHES RESEARCH & DEVELOPMENT LABORATORIES ..... 100
Agency—Foote, Cone & Belding
HYDRO-AIRE, INC. ..... 24
Agency—Byron H. Brown & Staff, Inc.

INTERNATIONAL ELECTRONIC RESEARCH CORP. ..... 85
Agency—Jayeraft Co. Adv.
INTERSTATE ENGINEERING CORP. ..... 74, 75
Agency—Wade Adv. Agency, Inc.

KAMAN AIRCRAFT CORP., THE ..... 93
Agency—Charles Palm & Co., Inc.
KIDDE & CO., INC., WALTER ..... 22
Agency—Cunningham & Walsh, Inc.
KOEHLER AIRCRAFT DIV. NEW BRITAIN MACHINE CO., THE ..... 72
Agency—Wilson, Haight, Welch & Grover, Inc.
KOLLSMAN INSTRUMENT CORP. ..... 86
Agency—Schaefer & Favre Adv.

LAMINATED SHIM CO., INC. (AIRCRAFT DIV.) ..... 6, 7
Agency—Wilson, Haight, Welch & Grover, Inc.
LITTON INDUSTRIES, INC. ..... 46
Agency—Calkins & Holden, Inc.
LOCKHEED AIRCRAFT CORP. ..... 42
Agency—Foote, Cone & Belding
LOCKHEED AIRCRAFT CORP. (CALIFORNIA DIV.) ..... 94
Agency—Hal Stebbins Adv.
LONG BEACH AEROMOTIVE ..... 101
Agency—Cole, Fisher & Rogow, Inc.

MALLORY-SHARON TITANIUM CORP. ..... 63
Agency—The Griswold-Eshleman Co.
MARTIN CO., THE GLENN L. ..... 60, 61
Agency—Vansant, Dugdale & Co., Inc.
MICRO SWITCH DIV. OF MINNEAPOLIS-HONEYWELL REGULATOR CO. ..... 36
Agency—Reincke, Meyer & Finn, Inc.
MONSANTO CHEMICAL CO. ..... 90
Agency—Gardner Advertising Co.
MORGAN STANLEY & CO. ..... 79
Agency—Doremus & Company
MORRIS BEAN & COMPANY ..... 87
Agency—Odiorne Industrial Adv.

NEW DEPARTURE DIV., GENERAL MOTORS CORP. ..... 17
Agency—D. P. Brother & Co., Inc.

PHILLIPS PETROLEUM CO. (AVIATION DIV.) ..... 5
Agency—Lambert & Feasley, Inc.
PITTSBURGH PLATE GLASS CO. (SAFETY GLASS) ..... 68
Agency—Batten, Barton, Durstine & Osborn, Inc.

ROBINSON CO., RALPH C. ..... 82
Agency—Chapin-Dunne Adv.
ROHR AIRCRAFT CORPORATION ..... 58
Agency—Battles Chase Company
RYERSON & SON, INC., JOSEPH T. ..... 80
Agency—Calkins, Holden, Carlock, McClinton & Smith, Inc.

SEARCHLIGHT SECTION ..... 101 to 113
SENSENICH CORP. ..... 55
Agency—Fultz-Wessinger, Inc.
SERVICE STEEL DIV., VAN PELT CORP. ..... 72
Agency—Claude E. Whipple Adv.
SOLAR AIRCRAFT COMPANY ..... 44
Agency—The Phillips-Ramsey Co. Adv.
SOUTHERN CALIFORNIA COOPERATIVE WIND TUNNEL ..... 98
Agency—The Perrett Company
SPERRY GYROSCOPE CO., DIV. OF SPERRY RAND CORP. ..... 3rd Cover
Agency—Reach, Yates & Mattoon, Inc.
STEINEN MANUFACTURING CO. WM. ..... 82
Agency—Reid, Decker & Stockl, Inc.
STEWART WARNER CORP. (ELECTRONIC DIV.) ..... 70
Agency—The Buchen Company
SURFACE COMBUSTION CORP. (JANITROL AIRCRAFT-AUTOMOTIVE DIV.) ..... 65
Agency—Odiorne Industrial Adv.
SUTORBILT CORPORATION ..... 64

TOWNSEND COMPANY (CHERRY RIVET DIV.) ..... 92
Agency—Bond & Starr, Inc.

WESTERN GEAR CORP. ..... 13
Agency—Ruthrauff & Ryan, Inc.
WHITTAKER CO., LTD., W. R. ..... 94
Agency—Mogge-Privett, Inc.
WICKES ENGINEERING & CONSTRUCTION ..... 78
Agency—The Roland G. E. Ullman Organization



HAMILTON STANDARD
ENGINEERS
are reaching
new heights

WITH SUCH CHALLENGING PROJECTS AS
AIR CONDITIONING
"The MATADOR"

ENGINEERS FOR
DESIGN • CHECKING
• DEVELOPMENT
• METALLURGY
• VIBRATION
• ANALYSIS

As high as the sky . . . the opportunities awaiting engineers right now at Hamilton Standard! Hamilton has already established a reputation for its work in the design, development and production of ingenious jet aircraft equipment. An *aviation engineering firm*, it has produced such products as fuel controls for America's most advanced jet aircraft, jet starters, air cycle refrigeration units, hydraulic pumps, and pneumatic valves. We would like to talk to you and point out the number of advantages to be had by working for Hamilton Standard.

*Please send resume to Mr. Kell Smith at*

HAMILTON STANDARD
HAMILTON STANDARD
DIVISION
UNITED AIRCRAFT CORPORATION
25 Bradley Field Road, Windsor Locks, Connecticut

# LETTERS

## IFR—VFR Snafu

The very thought of 100% Instrument Flight Rules being imposed upon all users of the skylanes has again prompted me to address you as a pressure group of one to suggest that modest publicity be given to the thought of change in one specific CAA regulation that might make joint IFR and VFR operation more compatible to the airline pilot group.

It seems to me that one currently effective CAA regulation permits an aircraft to be considered VFR (so called see and be seen rules) when it may be as close as 2,000 ft. horizontally to a cloud as long as the other rules of ceiling and presumably forward visability are met. This rule seems to legally sanction the practice to skirt around a cloud VFR at any speed and be as close as 2,000 ft. to the cloud. Another aircraft on the opposite side of the cloud can be doing the very same thing set on a collision course that would make it impossible for the pilots to avoid a collision by the time they legally observed each other.

Law interpretation is not one of my strong points so when flying VFR I attempt to follow the law of self preservation and give all clouds a very wide berth. I am concerned when flying IFR that I might legally pop out of a cloud at a so-called green light controlled altitude and find another aircraft legally VFR but only 2,000 ft. from our funerals.

I can understand the airline pilot group's desire to have some changes made but it does not seem to me that the solution rests in forcing everyone IFR in one royal sweep but rather in exploration of changes in ambiguous rules and in general pilot education so that IFR and VFR can be agreeable to all.

It could well be that they (airline groups) have already given some thought to this little stinker of a 2,000 ft. horizontal to a cloud rule, but I have not noticed anything in the aviation press about it.

ROBERT E. TRIMBLE
1708 W Street, S. E.
Washington 20, D. C.

## ARDC Enthusiasm

The long-awaited "ARDC" issue of AVIATION WEEK finally arrived at this office and was immediately the object of all attention.

After my first casual perusal, and a later more thorough reading, I am extremely impressed by the superb job that you and your staff members did. The magazine will occupy a prominent place on our shelves, and will be referred to frequently for factual items on the Command.

Speaking for Lt. Col. Larry Krogh, who is now enjoying a brief vacation, and myself —we want to pay special tribute to Phil Klass and Russ Hawkes for the fine stories on Electronics and Geophysics. Depite the slight fuss raised by our GRD people, I thought the story turned out well. Another special note of thanks to Evert Clark, who was most helpful to us in furnishing guidance on just what was needed, and when.

Reports from various labs and sections indicate that the entire Center shares our enthusiasm for the excellent job you all accomplished. Not only the Command, but the entire Air Force, owes you and your colleagues a very sincere thank you.

GEORGE D. WOOD, JR.
Chief, Public Information Branch
Office of Information Services
Air Force Cambridge Research Center
Bedford, Mass.

***Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.***

## Pilots' Case

Your recent editorial entitled "We Are All to Blame" was very appropriate. In my opinion you quite accurately appraised the situation.

In reference to your comments relative to the airline pilots, some of us have been quite aware that we were not pressing our case in a manner which would effectively get the kind of action that will force results.

Thank you for your timely comments as expressed in your magazine regarding this matter.

W. H. DRUMMOND
12126 Juniette St.
Culver City, Calif.

## Comet Accident

I enclose herewith copies of correspondence in connection with the efforts of this Federation to secure factual information on the Comet accident at Karachi on 3rd March 1953.

In forwarding this material I realize that it is no longer news. It does, however, seem to illustrate in a clear manner that, in the investigation of air accidents, one law exists for the company and a different law for the pilot. This is, of course, not universally the case but, whenever it appears to be so and whenever this Federation, representing 15,000 civil pilots of the world, can find sufficient evidence, we feel bound to raise a protest—not only in the interests of the pilots but also in the interests of the public, whose security is threatened every time the cause of an accident is erroneously assigned.

We believe it to have been erroneously assigned in the case of the Karachi Comet accident but have been denied actual proof by the attitude of the British Ministry of Transport & Civil Aviation and, apparently, of the manufacturers—as shown by the somewhat unique passage:

> "I regret to have to tell you that de Havillands have reached the conclusion that release of the document concerned would tend to mislead since some of the detailed information is open to misinterpretation if taken out of the context of the report while the whole report is open to misunderstanding if separated from the discussions and actions which preceded and followed it. Under these circumstances they are not prepared to release the report to your Association."

Unfortunately it has to be anticipated that aircraft accidents will continue. The only hope we have of holding them in check is that all accidents are rigorously investigated, all evidence freely and impartially presented and all the authorities involved play their part to the full. This, clearly is not being done at present in the United Kingdom and the action we have taken in protest is the only one left open to us.

CAPT. C. C. JACKSON
Technical Secretary
International Federation of Air Line Pilots Associations
London, England

## Scurrilous Sketch

Having long been aware that no love affair was in progress, or impending, between Lockheed and Douglas, it would come as no surprise to me to discover that the scurrilous sketch and slogan appearing on p. 72 (AW, Aug. 13) were the offspring of a Douglas artist. I'd prefer to believe it happened this way, i.e., you merely used "cold" a sketch fed to you by some individual who was either anti-Lockheed or pro-Douglas or both—for I respect your impartiality too much to believe you would stoop to this sort of thing on your own initiative.

There is, as the sketch reveals, a greater similarity than most of us had recognized. But the resemblance is limited to the plan view shown. A side elevation would point up obvious external differences. And as to performance . . . !

I object strongly to the inference that Douglas inspired, in any way, the design of the F-104. I thought the paraphrase of Lockheed's world-renowned slogan was in extremely poor taste!

C. JAMES PARIS
Lockheed Aircraft Corp.
Van Nuys, Calif.

*(The drawing in question was submitted to Aviation Week by an aircraft industry engineer with a sense of humor and Aviation Week published it in the spirit with which it was submitted. The engineer does not work for either Douglas or Lockheed.—Ed.)*

## Aviation Education

Your reference to youth aviation education in a recent editorial is very timely ("Need for Air Age Education", AW, March 26, p. 21).

Aviation in general would become much more progressive and productive if everyone concerned would increase their youth aviation activities.

TOM SUTOR, CHAIRMAN
Aviation Committee
Florida State Exchange Clubs
Coral Gables, Fla.

From the Laboratories Famed for Precision Compasses

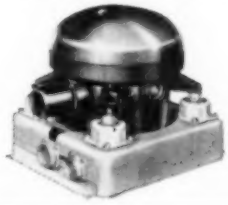
# THE NEW C-10 GYROSYN*

## . . . a Complete "World-Wide" Compass System Meeting Advanced Specifications for Polar Flight—**Yet Weighing Only 20 Pounds!**

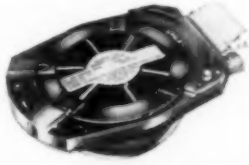
**MASTER INDICATOR**
Approx. weight 4¼ lbs.
Cut-out Dia. 3⅛ inches
Clearance behind
panel 10⁹⁄₁₆ inches

**CONTROLLER**
Approx. weight 1 lb
Height 2⁴¹⁄₆₄ inches
Length 5¾ inches
Clearance behind
panel 3¹¹⁄₁₆ inches

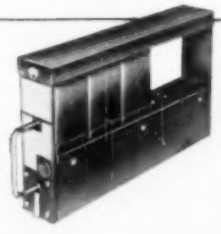
**DIRECTIONAL GYRO**
Approx. weight 8¾ lbs.
Width 7³⁄₃₂ inches
Height 7½ inches
Length 8³⁄₃₂ inches



**FLUX VALVE**
Approx. weight 1½ lbs.
Width 3½ inches
Height 2³¹⁄₆₄ inches
Length 4²⁹⁄₃₂ inches



**RACK ASSEMBLY**
Approx. weight 5 lbs.
¼ ATR
12¾ inches long



For more than a decade, Gyrosyn compasses by Sperry have set the standards of the aviation industry for commercial and military aircraft alike. Every day, hundreds of thousands of precision, on-course miles are flown with the aid of these accurate and dependable instruments. Yet in the Sperry laboratories the search for even greater accuracy and precision never ends—as evidenced by Sperry's most recent development, the C-10 Gyrosyn.

**THIS IS PRECISION**

At latitudes under 65° where the C-10 Gyrosyn is "slaved" to magnetic headings, accuracy is assured within ¾ of a degree. At latitudes above 65°, where magnetic headings are unreliable and the C-10 Gyrosyn is unslaved, random drift is less than 3° per hour. This compares with an average random drift of 8° to 16° per hour with many slaved compasses in use today.

**THIS IS EFFICIENCY**

A separate latitude corrector also automatically compensates for earth rate drift of the gyro, whether slaved or unslaved. Reliability of the system is further assured through the direct-drive nature of the master indicator which precludes transmission errors common to repeater-type instruments.

**THIS IS THE ANSWER**

. . . for today's faster-flying conventional aircraft and for tomorrow's turbo-prop and jet airliners. The C-10 Gyrosyn is recommended as the directional component of the SP-30 Flight Control System and the Integrated Instrument System, both of which are standard in the Douglas DC-8. It can be applied readily to modernize flight instrument equipment in existing aircraft. For complete information on the Sperry C-10 Gyrosyn, as well as other developments in the field of precision instrumentation, write our . . .

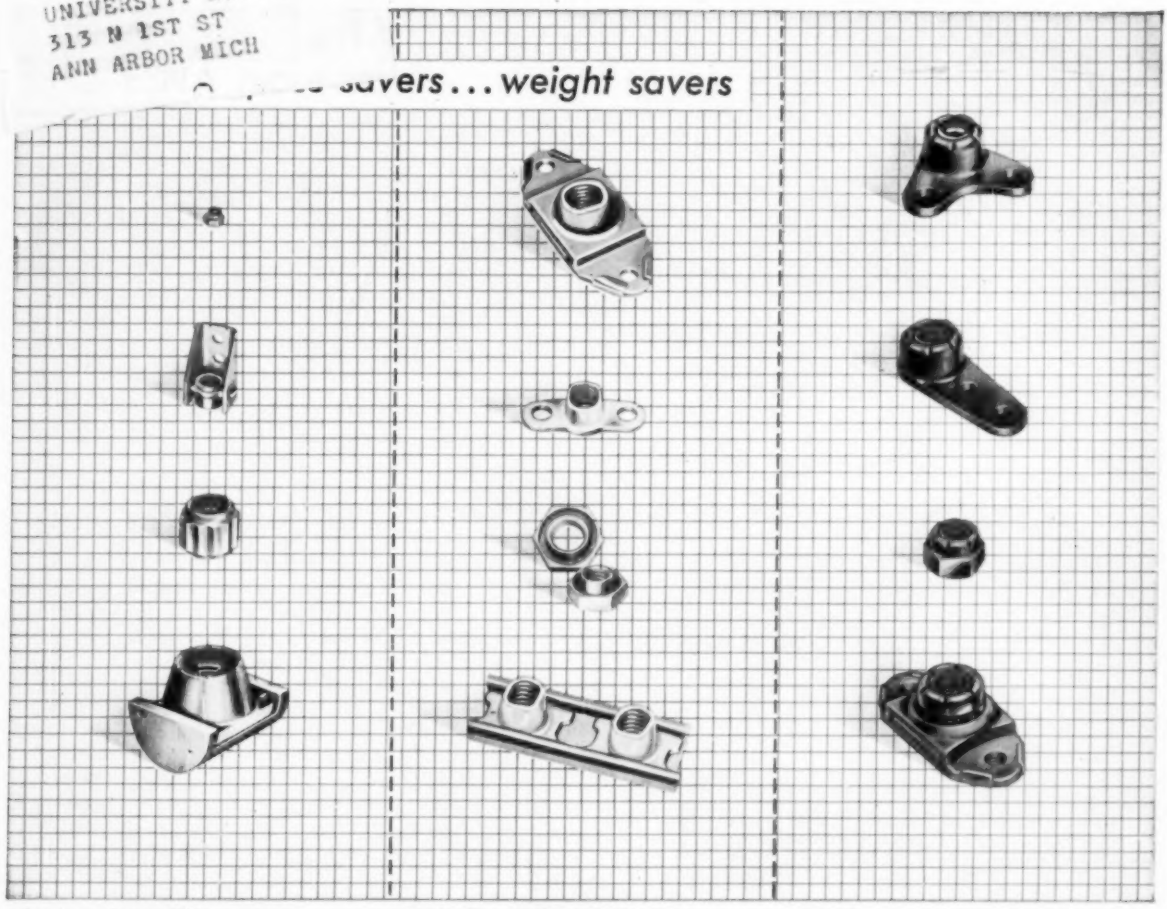
SPERRY *Aeronautical Equipment Division*
GYROSCOPE COMPANY
*Great Neck, New York*
*DIVISION OF SPERRY RAND CORPORATION*

CLEVELAND • NEW ORLEANS • LOS ANGELES • SAN FRANCISCO • SEATTLE. IN CANADA: SPERRY GYROSCOPE COMPANY OF CANADA, LIMITED, MONTREAL, QUEBEC

*T. M. Reg. U. S. Pat. Off.

E B POWER
UNIVERSITY MICROFILM IN
313 N 1ST ST
ANN ARBOR MICH

savers . . . weight savers



**Insert nuts for versatility . . . strength**

The famous red elastic nylon locking collar is available in nuts from 1/10" to 4" across the flats—in every hex and "fixed" plate nut configuration. High tensile parts offered in anchor, 12-point and barrel nut designs. For temperatures to 250°F.

**The LH line—for high temperatures**

Lighter, high temperature (to 550°F. in carbon steel—to 800°F. in stainless steel) nuts in sizes down to #4. Available in most configurations including ESNA's new full strength, lightweight, low-height hex nut, miniature anchor nuts, floaters and gang channels.

**Blue "J's"—where weight is most important**

The lightest self-locking nuts made. High strength aluminum alloy, nylon inserts. Completely interchangeable size for size with similar AN steel parts—and, on the average, 60% lighter. Dyed blue for quick identification.

# Why design around a nut?

Whether the need to save space or save weight is paramount . . . ESNA's complete line of self-locking nuts permits the designer to match the fastener to the problem.

Check Elastic Stop® nut standard drawings first . . . and enjoy the design resourcefulness permitted by the broad variety of field tested self-locking fasteners. This complete line of fasteners is the result of ESNA's more than twenty-five years experience in designing and producing to the aircraft industry's exacting quality standards.

Dept. N8-925, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

☐ New ESNA catalog

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____

ESNA®

Elastic Stop Nut Corporation of America